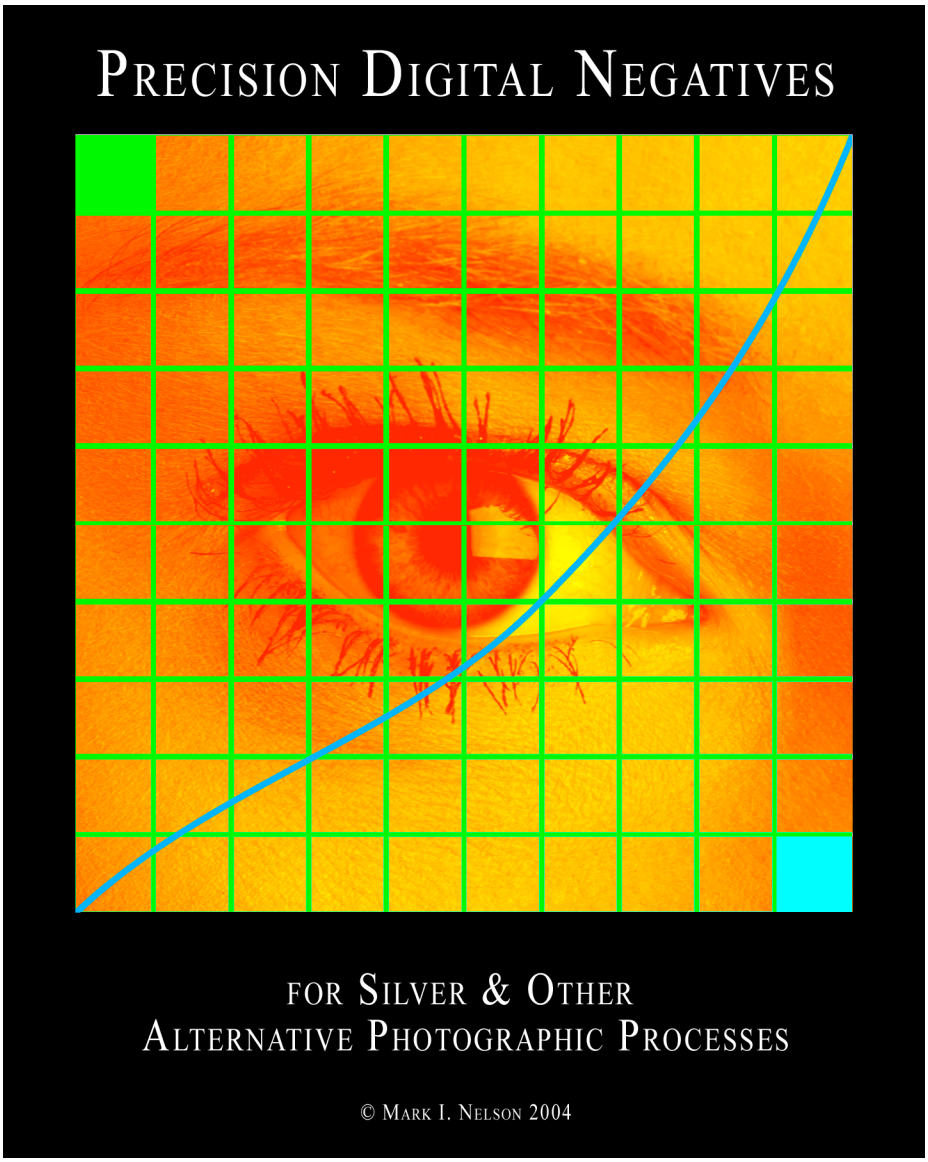
PRECISION DIGITAL NEGATIVES

FOR SILVER & OTHER ALTERNATIVE PHOTOGRAPHIC PROCESSES



MARK I. NELSON

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DEDICATION & THANKS

At risk of sounding like someone accepting an Oscar for Technical Achievement, I would like to honor some people that have been both dear to me and are a part of who I am.

DEDICATION

I would like to dedicate this book to:

- My Children, Kati and Jeff, who are my delight. Jeff spent countless hours listening to me babble on about *The Book* and asked good, thought provoking questions. Dr. Kati, Assistant Professor in the Computer Engineering Department of the University of Wisconsin was a great computer resource.
- My Children's Mother, Pamela, who has been a great partner in raising two children.
- My Mother, Nellie Nelson, who taught me how to sketch and shade with a pencil. She taught me that between black and white there are infinite shades of gray—both in art and life.
- My Father, Leland Nelson, who taught me the value of good tools and good craftsmanship.
- My Brother, Gary Nelson, who taught me about adventure.
- My Sister, Linda Nelson Stocks, whose success as an artist has been an inspiration.
- My Friends, Tom, Barb, Frank, Dale, Bill, Kathy, Sam, Bruce, Nancy, and Jerry who have been so wonderful through the years and particularly supportive of my research and writing.
- My Friends, Nicole, Tiffany, Deb, Laura, Clayton, Agi and many others, who collaborated with me and honored me with their trust and the privilege of photographing them.
- And, last, but not least, LadyHawke, who has been an inspiration both in life and art.

THANKS

I would like to thank:

- The following people for their encouragement, support, criticism, and hard work in assisting with the testing this system with various alternative photo processes: Sam Wang, Sandy King, Bruce Starrenburg (LightBox, Inc.), Dick Arentz, Phil Davis, Peter Ellzey, Christine Anderson, and Amy George.
- Sam Wang, Sandy King and Dick Arentz were especially helpful with beta testing, continual encouragement, and providing a wealth of knowledge regarding alternative processes.
- The wonderful, talented, knowledgeable and sometimes feisty folks on the Alt Photo list.
- The folks at Paul's Family Restaurant, Eric, Elaine, the waitresses, and the busboys who brought endless cups of coffee while I did my morning edits for nine months.
- Thanks to Wynn Bullock for his beautiful images and inspiring words.

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CHAPTER I: INTRODUCTION

This chapter provides some background information on the book and information about the contents of the book.

HISTORY & DEVELOPMENT

The process for making enlarged digital negatives for contact printing described in this book, is the result of over seven years work making digital negatives for myself and for other photographers.

I was fortunate to begin my photographic journey at a time when so many options were opening up. I was introduced to computer graphics years ago through my professional work. Since I had settled on the 35 mm format long ago, it was only natural that I turned to enlarging negatives digitally for contact printing. My first digital negatives were made with an imagesetter and were crafted for printing gelatin silver prints. After a great deal of trial and error, I was able to develop a system that gave me a custom curve for my favorite selenium toned, fiber paper. The ability to make identical prints so easily after having scanned the film and performed the "burning and dodging" only once in the digital darkroom was a lifesaver to me. This led to creating curves for other gelatin silver papers and eventually to applying the system to Platinum and Palladium prints.

Soon thereafter, I heard about the pioneering work being done by David Fokos and Dan Burkholder. After trying the "Fokos Curve" and the "Burkholder Curve," and comparing the results with my own, it became apparent to me that there probably was not a "Holy Grail of Curves." This seemed to make sense because everyone was using a different workflow. Unknowingly at that time, due to the method I used, I had accounted for all my workflow variables when developing my own custom curve. But still I was limited by depending on "The Curve" to do all the work. I later discovered that this was a critical error to make when crafting digital negatives—and probably a legacy of the initial workflows with imagesetter negatives.

For over a year prior to publishing *Precision Digital Negatives for Alternative Photographic Processes*, I spent the majority of my time researching the digital negative. My desire for a better understanding of how they work led to experimenting with ways to improve them. I did so because I wanted the technical ability to make the best possible prints using digital negatives.

I conducted endless tests, primarily with Platinum and Palladium, since I knew that this process would give me the controls I needed and there would be a lot of experienced printers in this medium who could critique the outcomes. The various standardized palettes and software used with this system underwent countless modifications before I was satisfied that they were easy to use and provided the information necessary to easily evaluate printing quality issues. I learned to never stamp an item "Final Version." The palettes and software that accompany this book will continue to undergo improvements.

Eventually I reached a point where I needed to know if this emerging system would work as well with alternative processes other than Platinum and Palladium. Knowing that I could not master that many alternative processes well enough to perform the tests, I enlisted a number of friends, such as Sam Wang, Sandy King, Dick Arentz, and Bruce Starrenburg, who are experts in printing a variety of alternative processes. This validation and the accompanying critiques were extremely valuable. In the end, it was the encouragement of Sandy King and Sam Wang that led me to write this book.

What started out as merely an effort to improve my own method of making digital negatives turned into a fascinating odyssey of discovery. I suppose I became a victim of my own curiosity—though pleasantly so. I wasn't convinced when I started my research that it was even possible to make a truly great print using a digital negative.

If I found it couldn't be done, I was resigned to using traditional methods for my enlarged negatives. Fortunately, I think I was successful. Each day I feel I am learning more about these wonderful processes such as Platinum and Palladium, which in turn leads me to new methods for improving my workflow and this system.

The Digital vs In–Camera Negative Controversy

There are topics in every field of endeavor that are likely to bring on a heated debate. Imagine the "discussions" that took place between the first photographers and the painters of that time. The rapid development of digital imaging and digital photography has led to another such debate. This book is not intended to fuel this debate nor be the final word.

I do not see either traditional in–camera negatives or digital negatives as preferable or one being superior to the other. I see them both as tools to be used in slightly different workflows to achieve the same end—a beautiful image rendered on fine paper by a photographic process that is capable of making that image sing to the viewer.

I do not hope that everyone will start making digital negatives to craft their prints. I do hope that many people will continue to use and improve in–camera negatives to make fine prints. The photographic community benefits from having this variety. Each method has its own benefits and pitfalls. Making prints using digital negatives is not an easy alternative if you consider the learning curve (no pun intended) of mastering the use of computers, scanners, digital cameras, printers and Photoshop™. To truly master each workflow is equally challenging. Experimentation with each method adds to the knowledge base for alternative photographic processes.

While technical skill in either method may lead to a "perfect print," the exercise is futile if there is no content in the image. Ultimately, what matters most is the final image and the impact it has on the viewer. All the expensive equipment, all the technical knowledge and skill in the world does not a great print make. I think the most important ingredient is that which comes from deep inside the artist—an artist who is willing to risk looking within as he or she studies the subject and forms a connection with it prior to taking the photograph. This connection continues to grow stronger and reach deeper as the photographer continues his journey with this image to the final print.

How This Book Is Organized

I have written this book with the understanding that it will be read by people with varying degrees of familiarity with both the digital world and the alternative photography world. Please bear that in mind should some of the material seem *old hat* to you. The structure of the book is designed to follow the workflow from image capture to final print.

There will be a great temptation to jump to the Calibration chapters, skim them, and start making negatives right away. If you can persuade yourself to resist this temptation, you will thank yourself later. There are a number of issues addressed in various chapters along the way that will improve your chances of success. Please read the entire book. I've hidden subliminal messages in the text that will improve your photography, increase your print sales, help you understand the Zone System, cause you to lose 15 pounds, and prevent your dog from having an accident on the living room carpet.

This book and system include some new terminology. I did not want to use photographic terms with slightly different meanings than those that are commonly accepted. You may find it helpful to read the Glossary of Terms before continuing.

Be sure to check out the lists of suggested reading and resources in the Appendix.

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What You Will Not Find Included With This System

You may wonder why you do not find a set of curves with this system for various alternative photographic processes. As you read the book and try this system, you will understand that there is no Holy Grail of curves that will magically provide you with perfect prints for any alternative photographic process. It just doesn't work that way. For the same reason, you will not find any recommendations for specific Standard Color Densities.

You will find very little information about alternative processes in this book. There are many great books and other resources available for this type of information. This book is about making digital negatives for alternative processes.

Alternative Processes Plus

The title of this book might suggest that this system might only be used with Alternative Processes, or 19th Century Processes, or Ultraviolet Sensitive Processes, or whatever you wish to call them. Actually the method works beautifully with Gelatin Silver Prints or hand coated silver emulsion prints. With silver printing, any special toning methods one might use can be built in to the calibration process. I might be going out on a limb to say this, but I think I can safely say that the method will work with any *monochromatic* process that can be contact printed.

How Good Can Digital Negatives Be?

There are two features of digital negatives that are often referred to when comparing them to analogue negatives or in–camera negatives. The first is the ability to render smooth tonal transitions and the second is the ability to render detail. Basically, I'm talking about holding a print in your hand and viewing it at reading distance—not examining the print with a microscope. I have shown prints to people and once mentioning that they were made with digital negatives, they would look at them more closely and suddenly "discover" that they see something "digital going on." I think had I not told them that the negatives were of digital origins they would not have either seen or imagined anything digital. But then, I'm over forty years old and way beyond my first pair of reading glasses.

Since the digital world is so easily quantified, I wondered if studies of human perception might shed some light on these two aspects of the alternative photographic print when rendered with digital negatives.

Obviously there are workflow issues that can intervene and result in a visually inferior print:

- The in camera negative may not be properly exposed or developed
- The digital camera may not be set for a proper exposure
- The scan may not be done properly
- The file may be 8-bit rather than 16-bit
- The digital file may be overworked and over sharpened
- The monitor may not be calibrated properly
- The printer may not be calibrated properly
- The print settings may not be adjusted properly when rendering the negative
- The density range of the digital negative may not match the exposure scale of the chosen process
- The adjustment curve for the negative may be too extreme

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When evaluating the print made from a digital negative there are also issues to consider:

- The quality of the vision of the viewer
- The quality of light in which the print is observed
- The distance of the print from the viewer

Technology will continue to advance, thus improving the quality of negatives that can be made, but what about the current capabilities of existing technology? How close is digital to meeting the demanding capabilities of human vision? If the workflow is optimized to produce the best possible results with properly calibrated state of the art equipment and a viewer with good vision looks at the print in good light, will prints made with digital negatives pass the test? I did a lot of research using both the Internet and all the books I could find. Below is a summary of what I learned.

TONAL QUALITY

The estimates of the number of tones that the human eye can distinguish range from 500 to 1,000 tones. However, when viewing prints, even under the best lighting, this threshold is reduced to between 250 and 500 tones, depending on the visual capabilities of the viewer. Though scanners and digital cameras can capture 16-bit files, Photoshop™ only works with 15 bit files, which provides 32,768 tones, well beyond the capability of the human eye to detect. However, monitors and output devices are all 8-bit devices—they can only render 256 tones. So, the best that can be expected is to generate a negative with all these 256 tones. This is roughly at the threshold of what the human eye can detect. Even if a file has all 256 tones in it, the output device must be well calibrated and the adjustment curve must be accurate or the difference between two neighboring tones may vary enough for the eye to detect it. Therefore it is extremely important that the workflow you use preserves all the tonality possible in the file, that you use the best possible output device to print the negative, and that the output device be in best possible working order.

DETAIL

Sharpness is usually thought of as how fine the detail is in an image or the resolution of the detail. Sharpness also depends on how well the edges of the detail are defined—acutance. Most digital devices measure detail in Line Pairs Per Millimeter. Think of alternating black and white stripes—how fine a pattern can a device render?

The experts suggest that a range of 5 line pairs per millimeter to 10 line pairs per millimeter is what the average person distinguishes as good detail and adequately sharp in an image. Currently most digital output devices can render between 300 to 480 pixels per inch, which is approximately 6 to 9 line pairs per mm. So it would seem that the digital negative should deliver adequately sharp prints. In some cases, this amount of detail may be beyond the ability of the papers and/or the ability of the emulsion used to render the detail of the negative. If you are not satisfied with this amount of detail, then you are a good candidate for using film recorders to render your negatives at up to 40 line pairs per mm—though be ready to spend $100 on each negative.

So currently, this is approximately what you can achieve with digital negatives. Of the two issues, I find smoothness of tone is far more important to me than detail. I put a lot of effort into devising a workflow that I feel maximizes this variable. This discussion did not address the aesthetic of the digital negative. That will come in later chapters, along with an understanding of how to achieve the aesthetic you are striving for in your images.

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CONTACT PRINTING

In the early years of photography, prior to the existence of projection enlargers and faster, modern photographic papers, prints were made by contact printing. A negative the size of the final print was placed over paper sensitized with one of the many alternative processes and exposed with sunlight. Since many of these wonderful processes were sensitive to the ultraviolet range of the light spectrum and no viable means of projecting ultraviolet light has ever been found, contact printing continues to be the method of printmaking.

For those valiant aficionados of the large format cameras that produce negatives of sufficient size to make a print, contact printing is quite easy and efficient—providing the densities of the negatives meet the requirements of the alternative process the photographer wishes to use.

For those of us who use small format or medium format film cameras, making a traditional contact negative requires a trip to the darkroom and enlarging the original negative to make a film positive and then making a film negative from that positive—unless a method of film reversal is used to go straight to an enlarged negative.

With the introduction of film scanners and digital cameras, a need arose for an efficient way of producing contact negatives from digital files. The digital negative for contact printing can provide an alternative with a number of benefits—even for those who use large format cameras:

- Digital negatives can be produced to meet the density range requirements of any alternative photographic process
- Digital negatives can be produced for any size print desired
- Digital negatives require no burning, dodging, or other corrections, since this is done in the original image file
- Digital negatives can be easily produced with a variety of interpretations of the image

Digital negatives can be produced from film negatives that were previously unprintable due to flaws such as scratches, dust spots, dog chewing, chemical stains or other defects

ULTRAVIOLET LIGHT

The Ultraviolet density values for many of the charts and graphs in this book are from measurements taken with an X-Rite 361T UV densitometer that I purchased used on EBay for $300. Scott Harig, from the X-Rite Corporation, was extremely helpful in providing specifications on the spectral sensitivity of this densitometer and software that would allow me to import all the readings directly into an Excel spreadsheet—an incredible timesaver considering the thousands of readings performed during the research conducted for this book.

Since there are a number of variables such as printer settings, ink sets, and other issues that might affect readings I would warn the reader against using any of these charts to *guestimate* density values for making digital negatives. They are only intended to give an indication of the relative densities of various ink sets and Standard Color Densities. I have noticed that actual printing densities vary somewhat from the density readings taken with the UV densitometer. The methods described in this book for determining a Standard Color Density are far more accurate and will be fine tuned to your chemistry, equipment, and workflow.

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Most of the tests done to develop this system were made using NUARC plate burners. Sandy King has done a great deal of testing of the characteristics of different UV light sources and published the results at an excellent web resource maintained by Ed Buffaloe, www.unblinkingeye.com. I would conjecture that the differences he found between the various light sources tested would also indicate some variance when used with digital negatives.

MATERIALS AND EQUIPMENT LIST

Specific materials required for making digital negatives are:

1. Computer
2. Digital image file
3. Reflection Densitometer or a Flatbed Scanner
4. Photoshop™
5. Microsoft Excel™ spreadsheet software
6. Light Table (optional)
7. Loupe (a 3x and a 10x are nice to evaluate at different magnifications)
8. Hygrometer for monitoring humidity (optional, but highly recommended)
9. Stopwatch (optional, but highly recommended)
10. Stouffer® or Kodak Standard 21-Step Tablet (transmission)
    or a Stouffer 31-Step Tablet (transmission)
    (the most important item on this list—and the cheapest)
11. One pair of lucky underwear (two pair preferred)

And if you are making inkjet negatives:

1. Inkjet Printer
2. Film substrate for printing negatives (Pictorico OHP Film recommended for most processes)

IF YOU HAVE QUESTIONS

I am unable to questions that are related to problems with other software, printers, computers, scanners, digital cameras, alternative processes, chemistry, dog training or other issues not directly related to this book and the PDN System. There are other sources that will be far more helpful to you than I would. If you do have a question about this system or a problem then try the following:

1. First, PLEASE READ THE BOOK FIRST! Most often I find that the questions raised by people are covered in the book.
2. If you can't find your answer in the book, Registered Users can find FAQ's located at www.precisiondigitalnegatives.com ,
   (Hopefully they will be available within a month or two after the book is published)
3. If the FAQ's don't have your answer, read through the user group discussions at www.precisiondigitalnegatives.com (Hopefully they will be available within a month or two after the book is published)
4. I will try to the best of my ability to answer questions about this book and software to the best of my ability. If you were unable to find the information you needed by trying #1, #2 or #3 above, then contact the author at: Answers@precisiondigitalnegatives.com.

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Safety Warning

Alternative Photographic Processes all use chemicals that can be hazardous to your health. Please observe all safety precautions when handling chemicals and equipment. Be kind to the environment when disposing of any chemicals. Also observe all safety precautions with ultraviolet light sources.

The digital processes described in this book can be addictive and harmful to your digits. I am sure there are various 12 step programs available in your area should you need assistance. Some signs of addiction are:

1. Stiffness in the wrist, fingers, neck, shoulders, and digits
2. Loss of sensation in the buttocks
3. Paper cuts
4. Blurry vision
5. Fatigue
6. Occasional sensations of euphoria
7. Fluctuations between Delusions of Omnipotence and Delusions of Impotence
8. Inability to fold laundry and iron socks (I suspect there may be other causes for this symptom, however it is often the first symptom to appear)

Sending Prints To The Author

Occasionally people like to send me a print they have made with this system. I may use the prints as examples in workshops and/or eventually have an online gallery for Registered Users of the book at www.precisiondigitalnegatives.com. If you do send a print, please include information regarding the process, chemistry, paper, exposure, etc. Prints cannot be returned.

To arrange to send a print, contact me at: Mark@precisiondigitalnegatives.com.

eBooks

I know some find it frustrating to read a book on a computer. The cost to have this book printed in color would have been prohibitive. I devoted a year and a half of my life to the research and writing of this book. I did not have any sponsors. I will never recover the costs of materials, equipment, and time lost pursuing my own photography from the sale of this book. I doubt if there will be movie rights sold, yet alone t-shirts. I loved doing it, I loved the adventure of discovery and I am proud of the book. I would do it again.

I hope to continue to do more research and development and make it available to you. In order to do that I need your help—by honoring the License and Copyright restrictions.

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Part 1
The Analogue To Digital Journey

Dogwood In The Rain —m nelson ©1999

When I photograph, what I'm really doing is seeking answers to things.
—Wynn Bullock

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CHAPTER II: DIGITAL BASICS

In order to understand the content in this book, it is important to be familiar with a few terms that are used in digital imaging.

PIXELS AND DOTS

One important aspect of digital imaging that confuses many beginners is the relationship between image size, file resolution, and the resolution of inkjet printers and other output devices—the difference between pixels and dots.

Pixels or points of different tones and hues define image files. The resolution of capture devices such as cameras and scanners or the resolution of monitors are all defined by how many pixels per inch (PPI) or millimeter they resolve.

Output device resolution is determined by how many dots the device can print in an inch (DPI) or millimeter. Dots are not the same as pixels. Output devices such as imagesetters and inkjet printers need to print a pattern or matrix of more than one dot to render each pixel in an image file with the appropriate tone and/or color. There is usually a ratio for each device of how many dots are needed to accurately represent a pixel.

The exceptions to the pixel/dot ratio requirement are the high end imaging devices such as Lightjet™, Lambda™, and Chromira™ that use lasers or LED's to image on paper and film. These devices can vary the tone and color of each dot printed in a one to one relationship to the pixels in the image file. This feature provides output that appears to be continuous tone to the human eye and even holds up well under close examination with a loupe.

DIGITAL IMAGE TONES

Digital negatives can render beautiful tonality, but, as you will see, they have their limits and all effort should be made to avoid going beyond those limits.

The *bit depth* of the file limits the range of tonal values of the pixels within an image file. You have probably heard the terms *8-bit* and *16-bit* images. The software and/or device used in capture determine bit depth of the image file. The bit depth numbers, such as 8, 10, 12, 14 or 16, refer to the number of possible tones that the file, software or device can accommodate. This number is actually applied as the exponent of the number 2. Thus an 8-bit image is 2 to the power of 8, or 256 possible tones from black to white. Sixteen bit images have 2 raised to the power of 16 or 65,536 possible tones—a big difference (actually half this number in Photoshop™ as you will read later). Thus 16-bit images give you much more room to make tonal adjustments to a file (Figure 2.1). Though some tones will be lost, a large number will survive.

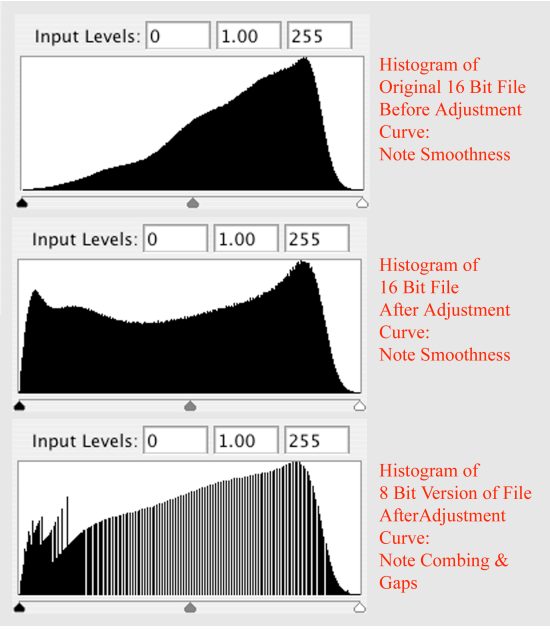
Input Levels: 0 1.00 255
Histogram of Original 16 Bit File Before Adjustment Curve: Note Smoothness
Input Levels: 0 1.00 255
Histogram of 16 Bit File After Adjustment Curve: Note Smoothness
Input Levels: 0 1.00 255
Histogram of 8 Bit Version of File AfterAdjustment Curve: Note Combing & Gaps

Figure 2.1 Tonal Loss With 8-bit file

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When tonal adjustments are applied to 8-bit files, gaps will appear at some tonal ranges (posterization) and other tonal ranges are compressed (loss of contrast). The bottom histogram of Figure 2.1, indicates the tonal loss (comb–like gaps which cause posterization in prints) that occurs when applying a curve to an 8-bit file. There are also spikes on the left of the image that indicate an increase of pixels falling in the shadow zones.

Since color or RGB files have three channels, one for each color, they may be referred to as 24 bit (3x8), 36 bit (3x12), or 48 (3x16) bit files. For the most part, this chapter refers to 16-bit grayscale files. The only exception to that is when printing negatives on a color output device. At that point, it is necessary to convert the file to RGB just for printing. Files that are used for printing negatives on imagesetters should remain in grayscale mode.

Notice I used the term *possible tones*. An image may not fill up the entire range of tones for a given bit depth, depending on how the image was captured or how the image was manipulated after capture. The best practice is to capture and to work images at the highest possible bit depth to preserve as many tones as possible. Every time you make an adjustment to an image, the image loses some tones because almost all image adjustment tools are destructive in nature. This issue becomes very important when you print your negative. Current imaging devices all render images with only 256 tones or as 8-bit images. While you can send a 16-bit image to an inkjet printer, it is converted to 256 tones during the printing process.

SENSITOMETRY

It's not unusual that the mere mention of the term sensitometry will cause a person's eyes to glaze over or an even more severe physical reaction—the dreaded *step wedgie*! This section is a very simple and brief discussion of sensitometry, though hopefully it contains enough information to carry an individual through the calibration process that will be covered later. There are a number of books by Phil Davis, Dick Arentz and others that give excellent, in–depth coverage of the topic of sensitometry. These books are listed in the Appendix B, under Suggested Reading.

THE LOGARITHMIC SCALE

The human eye is an incredible organ. It is capable of functioning under an extraordinarily wide range of illumination and capable of perceiving quite small variances of tone in optimum lighting conditions. Human vision processes illumination and tonal variances in a logarithmic relationship rather than arithmetic or linear relationship.

The logarithmic (Log) values used in sensitometry are a handy means of measuring the relative transmission density of film or reflection density of prints. Log values, when expressed as the exponent of the number 10, can represent a very large range of values with a very small number. For example, 10 to the power of 4 is 10,000—thus the log of 10,000 is the number 4.

You are familiar with the fact that successive F-stops, such as F/11, F/16, F/22 double or halve (depending on which direction you change the aperture) the amount of light that strikes the film. This progression of doubling or halving light and density can be expressed logarithmically by the value log .30, since 10 to the power .30 is approximately equal to 2. So, changes in density that are double or half a given amount can be represented by adding log .30 or subtracting log .30. If a given exposure produces a Log transmission density of 1.2 and you wished to double the density of the film by doubling the time it is exposed or opening up one full F Stop, the difference in the density would be log 1.2 + log .30 or log 1.5.

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In the case of films, the log transmission density is a measure of how much of the light from a standard light source is allowed to pass through the exposed film. In the case of papers, the log reflection density is a measure of how much of the light from a standard light source is reflected from the exposed paper.

Most everyone is familiar with the density curves of both film and paper (Figure 2.2). These curves tell us a lot about a film or an alternative process emulsion. They tell us how much exposure is required to achieve a certain level of density. They also tell us what range of exposure will provide useful information in film or print. These curves are based on measurements taken with densitometers that provide readings in log values.

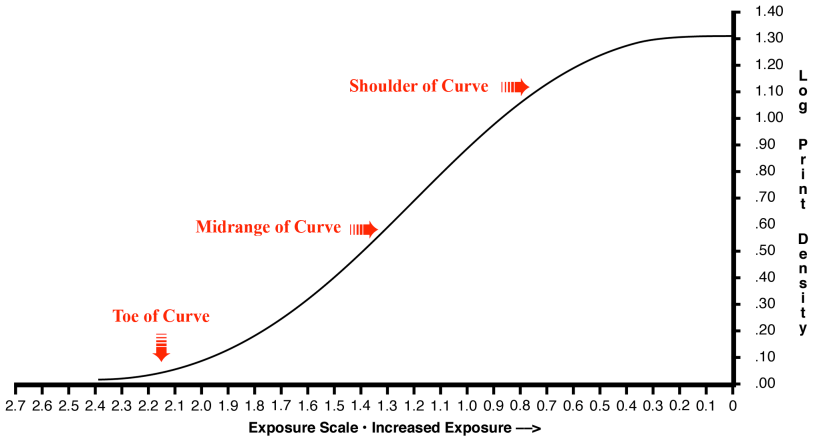

Figure 2.2 Print Density Curve

Steps & Stops

Throughout this book you will find numerous references to Standard 21 Step Tablets and unending instances of encouragement to use them. These useful tools, since they are standardized, are the magic yardsticks that provide invaluable information to help bridge the gap between the analogue and digital world. Step tablets have a series of steps of increasing density that is based on logarithmic values. The Standard 21 Step Tablet (transmission), has 21 steps measuring from step #1 (clear film) log .05 to step #21 (DMax) log 3.05. In this case, each step of the 21 steps is in increments of 1/2 stop or log .15. By exposing a step tablet using any alternative process, it becomes easy to determine how sensitive the alternative process is to the light source—it is like making 21 exposures at once. The resulting print of the step tablet can show if the exposure is sufficient enough to achieve the greatest density possible. The print of the step tablet can also show the range of exposure possible with a given alternative process. The step tablet can also show if the alternative process chemistry and exposure is consistent between printings. By examining the results of printing a step tablet, it is easy to determine how much to increase or decrease exposure. Since the difference of two steps is exactly one full stop, to make a difference in printed density of two steps the exposure would be either doubled (to increase density by two steps) or halved (to decrease density by two steps).

The Digital Tonal Scale

When making the daring leap from the analogue world of photography to the digital world, it may be difficult at first to understand how the numeric representation of a grayscale image translates to the real world without looking foreign to the human eye. Though a 16-bit grayscale image may have thousands of tones, you don't really see them, but trust me, they are there. What you do see is an 8-bit representation of them, either on your monitor or in the digital prints you make, because that is all the tones these devices are able to render.

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If you have worked with a digital image file in Photoshop™, you have become familiar with the method of representing levels of tones with the numbers 0–255, where 0 represents black and 255 represents white. This arithmetical scale is very convenient for digital files, since it can be expressed in digital language as a byte. The values, however, only tell you if they are lighter or darker—not how much darker or lighter as when reading the log values of a step tablet with a densitometer. But magically, it all seems to work when you view an image on the screen or make a print with an inkjet printer. This bit of magic is due to curves, or transfer functions, used by monitors and printers to convert this arithmetic scale to levels of luminance or ink densities that appear true to our eyes. This is why it is important to calibrate monitors and printers so that this conversion will be done properly, since, to a computer, a tone is just another number in a file.

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CHAPTER III: DIGITAL IMAGE CAPTURE

The digital image file may originate from film that is scanned or a digital camera. The process prior to converting the image to a negative and making a print can be divided into two phases, the Image Capture Phase and the Image File Preparation Phase.

The following suggestions cover just a few of the more important issues related to capturing a digital image with a scanner or digital camera. There are whole books written on these topics. In them you will find more in–depth coverage than possible in this chapter. One of my favorites is *Real World Adobe Photoshop CS*, by Bruce Fraser and David Blatner.

SCANNING

Scanner software varies a great deal from one scanner to the next. I know it is unpopular to do so, but read the manual so that you understand the features of the software and how you can get the best possible scan. The following suggestions are fairly simple and should produce excellent scans.

DON'T BELIEVE THE MANUFACTURERS' CLAIMS

The current practice of scanner manufacturers is to make outrageous claims for the ability of their scanners to scan negatives or positives with densities equivalent to a black dinner plate. I think they do this because everyone else does it, so they want their scanner to look competitive. I am referring to high numbers given for the DMax of the scanner or Dynamic Range of the scanner. These numbers are usually computed in a way that is totally meaningless in practical application. Sometimes it is merely the bit depth capability of the software that is bundled with the scanner. If you can test a scanner before you buy it, test it with the most dense negative you have and see how the scanner performs. If you have access to a scanner film test target, use that. If you have thousands of negatives that you exposed for Platinum/Palladium printing and you can't wait to get home and scan them all with your new scanner, you may be very disappointed unless you have tested the scanner. If you plan on scanning all your film, then you may want to examine how you expose your film and see if it matches your scanner's capabilities. If not, maybe you should modify your exposure/development practices to fit the scanner's capabilities—or get a better scanner.

SCANNING FILM OR PRINTS

The best possible image files come from scanning the original film. This reduces the number of steps that the image has gone through that cause a reduction in fidelity of the image. A good flatbed scanner can provide excellent results with negatives from 6mm x 6mm up to 5" x 7". Smaller negatives are best scanned with dedicated film scanners. Negatives larger than 5x7 present a problem since most scanners cannot accommodate the size. Scanning sections of a negative and stitching the scans together is an option, but not a very good one, since there is often a problem of uneven lighting with the joining borders. Some service bureaus may be able to scan these larger negatives.

A major advantage in scanning film over prints, in addition to sharpness, is the wider dynamic range a negative contains over prints. Printed images are compressed and contain far fewer levels of tone. A good negative scanned in 16-bit format can provide a very robust digital image.

If you must work from a print, scan the print in 16-bit color mode and then convert the image to grayscale in Photoshop™ using one of the methods described later in this book.

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Auto Scan Settings

Some scanning software will configure itself automatically for scanning. All you have to do is click a button to achieve what will probably be a substandard scan. These settings are probably designed for scanning color snapshots and may not provide the quality you are looking for. Auto Scan settings are notorious for clipping the highlights and shadows. Turn off auto–everything and set the scanning parameters manually.

Selecting the Scan Area

Selecting the scan area is important because the histogram that is generated for adjustments is usually based on the area selected. If no area is selected, then the histogram may include the scanner top or the negative carrier, which is not really the data you want to evaluate. If you have a question about the tones in a particular area, you can select the smaller area of concern and do a pre–scan on that area to determine where the data is falling in the histogram.

The Histogram and Setting Endpoints or Black & White Points

This is one of the most important settings made during the scanning process. Most scanning software has a histogram tool such as shown in Figure 3.1.

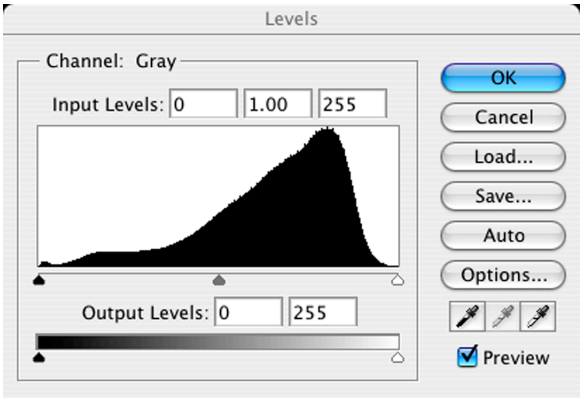

Figure 3.1 Normal Histogram—No Clipping

The histogram is a graph of the data values in a digital image. It shows the frequency of the various tonal levels in the image file with the darker values on the left and the lighter values on the right. These values come from the image that is derived from the pre–scan. The histogram is used to define what range of information in the potential scan is useful. This useful range of information falls between the two endpoints, the Black Point and the White Point. The Black point is the tonal level on the left that defines where absolute black (level 0) will fall. Once it is set on the slider, all data falling to the left of the Black Point will be assigned to level 0, absolute black. Conversely, the White Point is the tonal level on the right that defines where absolute white will fall. Once it is set, every tonal value to the right of that point is assigned to level 255, or absolute white. You can see why setting these two points is critical.

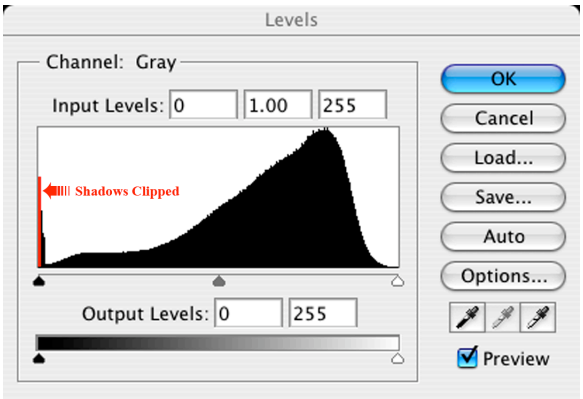

Figure 3.2 Histogram With Clipped Shadows

If the Black Point is set too far to the left, then the areas of the image that should be deep black will be a lifeless gray. If the Black Point is set too far to the right, then much of the rich shadow tones will become a black hole. The best setting is just slightly to the left of the first pixel that you want to be absolute black. The histogram in Figure 3.2 shows an image where the Black Point has been set too far to the right, clipping the shadows—notice the piling of data on the left end.

Similarly, if the White Point is adjusted too far to the left, then the highlights will be blown out. If the White Point is set too far to the right, the highlights will be too gray.

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The best setting is just a bit to the right of where the highlights begin—even specular highlights. This setting of the White Point can sometimes be deceiving, since there may be very tiny areas of near white that do not register on the histogram—such a portion of the white of an eye in a portrait.

The histogram in Figure 3.3 shows an image where the White Point has been set too far to the left, clipping the highlights—notice the piling of data on the right end. When properly adjusted, the Black Point and the White Point will yield a histogram like the one shown in Figure 3.1.

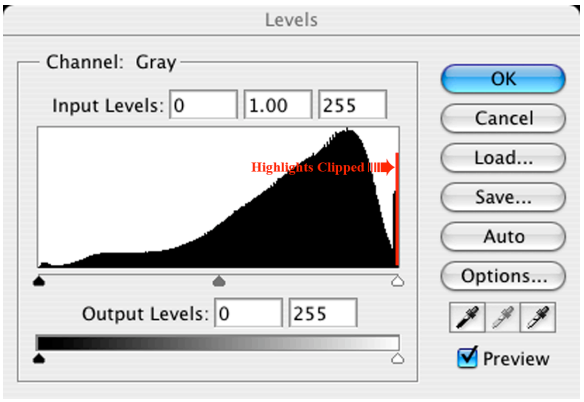

Figure 3.3 Histogram With Clipped Highlights

This method of setting the Black and White Points just outside the range of the relevant image data works very well when scanning in 16-bits. It gives you some breathing space without sacrificing any shadow or highlight detail. Though it may not allow the range of useful data to span the entire histogram, a 16-bit file is rich enough to accommodate this transgression easily. It is far better than clipping either end of the data. Once the file is in Photoshop™ you will be able to refine these settings more accurately and in a non–destructive manner by performing the Levels Adjustment in a layer.

Curves & Gamma Adjustment

There are other adjustments that can be made during the scan. One is the Gamma Adjustment and the other is the Curves Adjustment. To a certain extent, this is a matter of workflow preference and there are two approaches. The first approach is to make as much adjustment as you can with these two tools to get a really full, rich histogram and then continue adjustment in Photoshop. The second approach is to do nothing and count on the fact that you are scanning in 16-bits to provide a rich enough file to do these adjustments later in Photoshop. I sort of take the weenie's way out (WWO) and compromise. One advantage I have is that my scanner software shows both the histogram of the pre–scan and a histogram of the data with all the current adjustments applied. Thus, I do some tweaking with Gamma and Curves to fluff up the histogram a bit when scanning, but my major adjustments are left for Photoshop™, where I have more control.

Scanning in Color or Grayscale

This is an issue that can always bring up a heated debate. Some people feel that with black and white negatives they get a better scan if they scan the negative in color. I have tested this with my scanner and software (Imacon) and see no difference in the quality of the scans. However, if I am working with a stained negative, I may try it both ways to see which gives me the most information from the negative. If I am scanning color negatives or positives, I scan in color and do the conversion to grayscale in Photoshop. When scanning a black and white print on a flatbed, as mentioned above, I scan in color. Resolve the issue for yourself by trying both to determine what works best for your hardware and software.

Bracketing Scans

Some negatives may have a density range that taxes the ability of your scanner/software. A setting that seems to capture the entire tonal range of the negative may produce a histogram that looks like a roller coaster from a nightmare.

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In such a case, try making two scans instead of just one and combine the two later in Photoshop™ using Layers. You can either blend the two scans or erase the highlights from one and the shadows from the other. When making the two scans this way, you can scan once for the highlights and once for the shadows using less drastic scanner settings.

When All Else Fails

There are times when you may find a negative just about impossible to scan. This is rare, but usually involves a negative with dense shadows. I can't explain why this method sometimes works and perhaps it is dependent upon the scanner and software combination. Try scanning the negative as a positive and then invert it in Photoshop™. Sam Wang has also used this method with scans that were producing noise in the deep shadows and the *positive* scan eliminated the problem.

Dust & Scratches Filters

Many people swear by scanner software with magic features that remove dust and scratches from the scan. I have tested a couple of them and found that they did more harm to the image than good for two reasons. First, in addition to removing dust and scratches, these filters also tend to eliminate some very fine detail in the image that you cannot recover later. Second, these filters sometimes leave behind subtle artifacts that are even more difficult to find and remove. There is no free lunch. I tend to deal with these problems later in Photoshop™ as described in the section on Image File Preparation.

Sharpening

All scanner software has some sharpening feature built into it. Usually you can control the amount. The best setting is OFF. Do all your sharpening in Photoshop™ and use the Three Stage Sharpening method described in the section on Image File Preparation.

File Format

Save scanned files in Photoshop™ format if the scanner software allows this. If not, use TIFF file format. Both these file formats are lossless formats. Do not save files in JPEG or some other format that compresses the files. The compression causes a loss of information and digital artifacts.

Service Bureau Scans

If you are having your scanning done by a service bureau, you will get better results if you have the service bureau do minimal adjustments when scanning and do the adjustments yourself later in Photoshop™. When sending the file to the service bureau, ask for:

1. 16-bit scan
2. No Sharpening
3. No cleaning unless it is done by hand spotting rather than global dust and scratches or some other filter application
4. True optical resolution scan with no interpolation
5. Scan resolution set for the final print dimensions or larger, in case you wish to do prints of a variety of sizes
6. Setting of black and white points with a little breathing room so that shadows and highlights are not clipped

Remember that not all drum scanners are capable of scanning in 16-bit mode. If you are working with a black and white negative, find a service bureau that can scan in true 16-bit.

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DIGITAL CAMERAS

Digital cameras can provide very good image files for digital negatives. Just as in scanning, it is important to take control of the camera and set it up to get the best possible images to start with. In most cases it is preferable to use Photoshop™ rather than the camera to make some adjustments, such as sharpening—you will end up with a much better image. The following are a few suggestions that will help provide better images from digital cameras.

FILE FORMAT

Digital cameras allow you to define the file format that the image will be saved in. Unfortunately the better formats usually take up more space.

RAW, if your camera supports it, is the best possible format to use for a number of reasons. It supports 16-bit images and, as the name implies, carries the raw data that the camera captured along with the camera settings. This means that when importing the RAW file into Photoshop™, the file appears as you shot it, but the camera settings can be modified to a certain extent. This allows you to fine–tune the image very nicely or discard the camera settings altogether. Obviously, if the image was grossly under or over exposed, this post processing cannot adjust the image enough to recover from such a bad exposure. Another advantage of the RAW format is that the file size may be very compact since some cameras use a lossless method of saving in RAW format. The Photoshop™ RAW plugin provides an excellent environment for processing digital camera files. This plugin is automatically initiated when opening a RAW file. Photoshop™ lists those camera RAW files that are supported.

TIFF files would be the next best solution in file format. They do not offer the post processing capabilities of the RAW format, however TIFF files will store the data in a lossless format. They do tend to be much larger. An image file stored in TIFF format may be 10 times the size of a RAW file.

JPEG format is the least desirable of the image storage formats. In order to achieve the small file size, the image is compressed with algorithms that destroy the integrity of the image tonality and detail. The greater the compression, the smaller the file size and the more digital artifacts are introduced into the image.

16-BIT VS 8-BIT

If your camera can produce 16-bit files, as mentioned above, by all means use that feature instead of shooting in 8-bit mode. If the camera does not offer 16-bit mode, then shoot with the highest quality color file. Once you open the file in Photoshop™, immediately convert it to a 16-bit RGB file. Next use the channel mixer to convert the file to grayscale mode. This will give you a much richer 16-bit grayscale file, since information from all the color channels is being used for the conversion.

FILE SIZE

This is an easy choice to make. Use the highest resolution that the camera offers! The more pixels the better the image. Files from digital cameras also have an advantage over scanned files. They can be interpolated up to a larger file to a greater degree and still maintain enough sharpness to print.

EXPOSURE

Although digital cameras have fine methods for auto-exposure, I prefer to set them manually if I can, so I can control depth of field and the length of exposure. This also makes it easier to avoid blowing out the highlights or blocking up the shadows. For some reason, it is far more common with digital cameras to blow out the highlights. If the camera has an exposure histogram, use it and watch the highlights carefully.

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Some cameras also have a thumbnail of the image that will indicate blown out highlights by flashing pixels—this is extremely handy! Camera histograms can fool you. Sometimes the histogram will look like you are underexposing the image, with no data in the upper quadrant of the histogram. This is especially true of scenes with a high subject brightness range. What may actually be happening is that a small portion of the image is much brighter than the rest, and though it isn't apparent, there may be a lot of important data that is hidden in a low flat line on the right of the histogram. If in doubt—bracket the exposures.

If you are faced with photographing a scene with an extreme subject brightness range that is beyond the capability of your camera, you may be able to capture the scene by making 3 exposures—one exposed for the highlights, one exposed for the shadows, and one exposed in between for the midtones. Use a tripod. Later in Photoshop™, you can combine the three shots into one image that renders the full tonal values of the scene.

Digital Color or Digital Black & White

Most cameras offer some monochrome options to color images. These options may include a black and white setting and/or a sepia toned setting. These options are not good options to use. The conversion methods used tend to destroy the tonal integrity of an image. Make these conversions in Photoshop™.

Sharpening

The sharpening controls on cameras tend to over–sharpen images. Turn off the in–camera sharpening or set it to the lowest value possible. A much better method of sharpening is covered in the section on Image File Preparation.

Contrast Settings

If the camera has a contrast setting, set it to the lowest value possible, a middle *0* value, or to *Off*—depending on how the setting works for your camera. Setting contrast too high on a digital camera is a common fault that leads to blown out highlights and blocked up shadows. Use the Curve Adjustment Function in Photoshop™ to more accurately adjust the contrast of the image.

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CHAPTER IV: DIGITAL IMAGE PREPARATION

While there are some important techniques that will be covered later to fine–tune the image, you are now at the point of making most of the major adjustments to the image file to match your visualization. It is very important that your computer monitor be calibrated so the image file is rendered accurately on the screen. If the monitor is not calibrated, you will not be able to make prints that match what you see on the screen.

This chapter follows a simple workflow that I use on 95% of my images. There is little that I do that could not be done in a wet process darkroom.

Open a new file and follow along.

TOOLS TO AVOID

Before continuing, I thought I would reveal my biases (though they are few) against some of the tools available in Photoshop™. I'm not referring to the filters such as Wind and some of the other obnoxiously cute affects that are so commonly used and abused with Photoshop. I am referring mostly to adjustments that begin with the term *Auto*. I don't use auto–anything, such as Auto Contrast or Auto Levels. These adjustments do not allow any control and tend to be very destructive to the image.

There are also tools that I never use because they are also destructive and introduce strange artifacts into the image. If I wanted that, I would add chemical stains and mold to my negatives before scanning them. These tools are the Dodge Tool, Burn Tool, Sponge Tool, Blur Tool, Sharpen Tool, and the Schmear Tool (just kidding!).

I also do not use the Brightness/Contrast Adjustment Tool. It is also a destructive tool.

RECOVERY SHARPENING

The first thing I do to a file is apply a small amount of sharpening called *recovery sharpening*. This is the first of three stages of sharpening I use with digital files. The purpose is to sharpen the image just enough to regain the amount of sharpness lost in capture with the scanner or digital camera. For this purpose, I use the Unsharp Mask Tool (*Filter>Sharpen>Unsharp Mask)* and set the sharpening controls as shown in Figure 4.1.

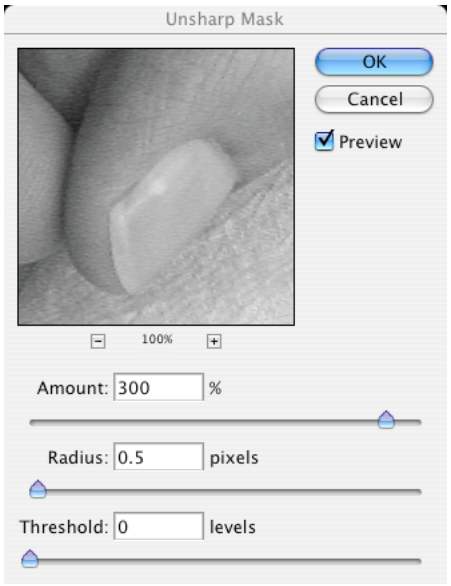

Figure 4.1 Unsharp Mask Settings

Notice the settings used:

1. Amount: 75%–300%
2. Radius: .5
3. Levels: 0

By examining the image at 100% while fine-tuning these adjustments I determine my exact setting. The Amount will vary from image to image in the range of 75%–300%. Avoid a setting that exaggerates the film grain of a scanned image.

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By doing the recovery sharpening at this point, it will make it easier for you to clean up any problems in the image file, since they will stand out more. Later, the second stage Local Sharpening and third stage Output Sharpening will be covered.

Conversion to Grayscale

If you are working with a color or RGB file, then this is a good point to convert it to black and white. There are two methods I like for doing this and sometimes I try both before settling on one. The first method involves extracting either the Red, Blue, or Green Channels from the file and using it as the grayscale image. The second involves mixing the Red, Blue, and Green Channels in a certain ratio using the Channel Mixer after trying different ratios to determine what seems to work the best. Either method, however starts with looking at the three color channels of the image to see if there are any problems with any of them. Open the Channels Palette first (*Window>Channels*) and you will see the palette as shown in Figure 4.2.

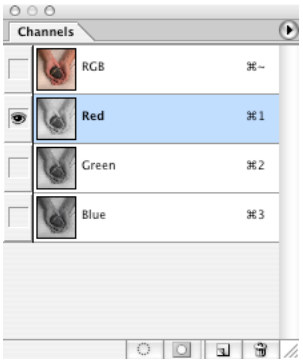

Figure 4.2
Channels Palette

By clicking on the *eye* icon next to one of the channels, you can toggle the visibility of the channel. Thus if you wish to only view the Red Channel, the Red Channel should be the only active channel with an *eye* icon next to it. By toggling through each of the channels, you can determine if any of the channels seem to be too noisy or have too much contrast. If one of the channels seems to be far superior to the other two, you may want to use the Split Channels command to extract it from the image.

If you are working with an 8-bit color file, I recommend using the Channel Mixer to convert to grayscale mode. If you first convert the file to 16-bit mode, then use the Channel Mixer, you will end up with a richer, *almost* 16-bit grayscale file by combining the data in the three color channels. Splitting the channels of an 8-bit RGB file would leave you with only an 8-bit grayscale file.

The examination of the three channels will also give you an idea of which channels may make the better channels to give priority when mixing the three with the channel mixer. Usually the Blue Channel will be the channel with the most noise and one that you will want to give less emphasis too.

Next open the Channel Mixer (*Image>Adjustments>Channels Mixer*) and you will be presented with the adjustment window shown in Figure 4.3.

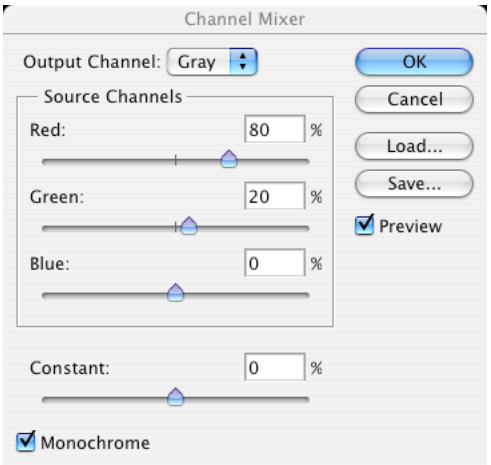

Figure 4.3 Converting to Grayscale Using the Channel Mixer

Note that the Monochrome check box in the lower left hand corner of the window must be checked. There is a slider for each of the color channels that you can move left and right. As you do this, you adjust the percentage of that particular channel will make up of the final image. The total of all the channels should not exceed 100%—sort of.

As you try different mixes of the channels, you will notice that the tonalities can change drastically. Think of this process as using color filters when shooting black and white film. You will also notice that the wrong settings can block up shadows or blow out highlights. Keep the file in RGB mode.

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The History Brush

Before I continue, I would like to introduce one tool that is invaluable in image file preparation—the History Brush. This tool seems to intimidate many people, so they do not use it. Actually, once you understand the basic concept, it becomes quite easy to use. The History Brush and a targeted Snapshot in the History Palette are shown in Figure 4.4.

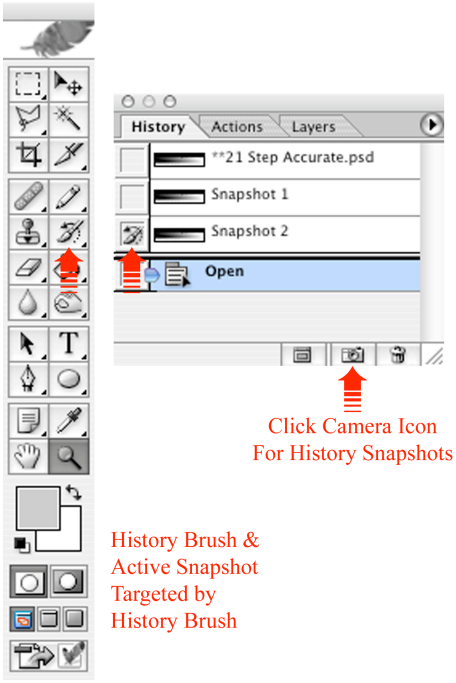

Figure 4.4 History Brush & Palette

The basic value of the History Brush is that it allows you to apply changes that are normally only possible as Global Adjustments (affecting the entire image) to one area of an image—and in the amount you want. This is possible because the History Brush works in concert with Snapshots from the History Palette. Thus a Global Change, such as Levels Adjustment can be made to the whole image, a snapshot taken, and then the Levels Adjustment undone by using the Undo Command or backing up one step on the History Palette. With the History Tool selected from the Toolbox and the Snapshot just taken selected as the History Tool Source, you can paint into the image the changes just for the local area that needs to be adjusted. You can even adjust the Opacity of the History Brush which allows you to brush over the area a number of times, adding the change in small increments. This is a very powerful tool that I use for local burning and dodging (in concert with the Levels Adjustment and Curves Adjustment), local sharpening (in concert with the Unsharp Mask Filter), and local Dust and Scratch removal (in concert with the Dust & Scratches Filter).

Image Cleanup

Now it is time to clean up the image. Like a crime scene detective *walking the grid*, go over the entire image at 100% resolution and touch up any dust spots, film scratches, or other problems stemming from the file capture. Use primarily the Healing Brush (my favorite) or the Clone Tool to do this. Sample a nearby area having similar texture and tone before clicking on the offending spot with the tool.

Avoid using the Global Tools, such as the Dust & Scratches Filter, to accomplish this task. The Dust and Scratches Filter may seem like a magic tool and a real time–saver, but it will also destroy some of the really fine image detail that you would like to preserve. It's rather embarrassing to make a print and find you have inadvertently removed someone's eyelashes with the Dust & Scratches Filter.

If you have a really serious problem involving a huge amount of tiny dust spots in one area, you might be able to use the Dust and Scratches Tool locally in combination with the History Brush to clean it. To do this, open the History Palette and then examine the area of concern at 100%. Open the Dust and Scratches Filter (*Filter>Dust & Scratches*) and adjust the parameters very carefully until you have just eliminated the dust without affecting the texture of the actual image data. Now apply the filter, take a Snapshot of the image (click on the little Camera Icon at the bottom of the History Palette) and then undo the Dust and Scratches Filter. Next select the History Brush and make the Snapshot you just took the active source for the History Brush by clicking on the checkbox at the left of the Snapshot. Now you can *paint out* the offending dust marks.

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Once the file is cleaned to your satisfaction, save it and re-open it with a new name. This new file is your working file. If something happens to it, you still have the original file to go back to and you will not have to repeat the tedious cleaning process. I would rather iron my socks than clean an image twice—well almost.

Minor Cropping

If you need to crop the image just to clean up the edges, this is a good time to do it. Some photographers, especially when working with sheet film, like to show the entire negative, including the borders. If you are not doing this, be sure to crop the non-image area out, since it will introduce false data into your histogram when you evaluate it.

Levels Adjustment Layer

Assuming you are using Photoshop™ CS (8) or later (if you aren't using it, get it!), you will be able to do much of your adjustments in Layers, which are non-destructive and can be tweaked as needed as your work on the image progresses. A Levels Adjustment Layer can be applied to the entire image or to a selection of the image. If there is no current selection or the selection is the entire image, the Levels Adjustment Layer will apply to the entire image. The following instructions assume the entire image area is being affected.

Create an Adjustment Layer for Levels Adjustment (*Layer>New Adjustment Layer>Levels*). During the image file preparation, this should be the only Levels Adjustment performed. Periodically while working on the file you can go back to this layer to double check the accuracy of the settings or modify them as you see fit. The Levels Adjustment Window utilizes a Histogram, which is a graphing of the frequency of the tonal values of the image. Using this Histogram in concert with the triangular sliders below it, you can adjust the Black Point and the White Point of the image as shown in Figure 4.5.

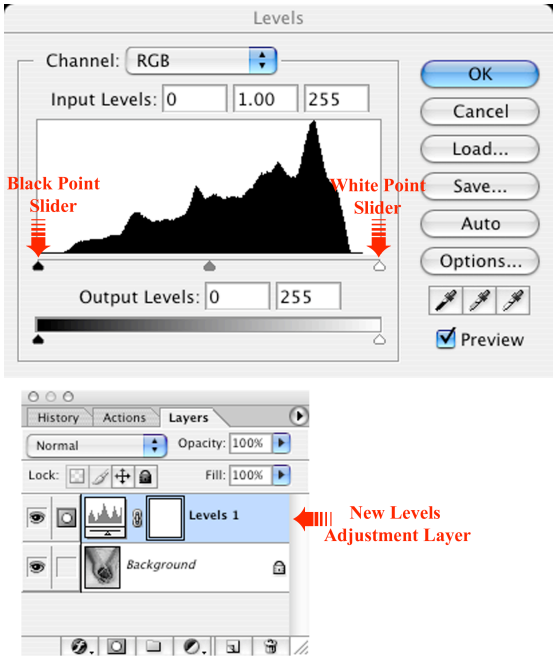

Figure 4.5 Levels Adjustment Layer

The Black Point slider, the black triangle on the left just below the Histogram, controls which values of the image will be set to pure black, or Level 0. As you move the Black Point slider to the Right, any value falling at or to the left of this point will be converted to pure black.

The White Point slider, The White Triangle on the right just below the Histogram, controls the values of the image that will be set to pure white, or Level 255. As you move the White Point slider to the Left, any value falling at or to the right of this point will be converted to pure white.

The numeric values displayed with the Histogram show tonal levels from 0–255. When working with a 16-bit file, think of these values (0–255) as a summary of the larger number of 16-bit tones. A Histogram that actually displayed over 32,000 levels of tone would be a bit wider than your screen could accommodate.

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Notice that as you slide either the Black Point slider or the White Point slider the entire image is affected. This occurs because resetting either of these adjustment points actually stretches or compresses the entire image file—thus the relative tonality within the image is changed. However, with a tonal rich 16-bit file, this is not a problem.

In the Image Capture section, I discussed the advantage of allowing a bit of leeway during capture with a camera or scanner so that the image file is not clipped in the shadows or the highlights. Clipping an image like this in the capture phase cannot be recovered. This offset to avoid clipping should be apparent in the Histogram you are looking at. The relevant image data should trail off to almost no data in both the shadows and highlights as shown in the above example.

The next step of setting the Black Point and White Point is a very important step that will have a great impact on the look and feel of the final image. Under normal circumstances you would want to set the Black and White points such that they just define the boundaries of relevant image data. On the other hand, consider the case of a very low contrast image, say a gray horse photographed on a foggy day. Imagine the Histogram this would produce. It would probably be a Histogram similar to the one shown in Figure 4.6. If the Black and White points in this case are set to the boundaries of the relevant data as indicated by the red arrows, the image data will be stretched so that there are true black and white values in the image. Is this desirable? Or, would you prefer to maintain the subtle gray values of the original scene? If the latter is the case, then the best approach is to slide the Black point only part of the way to the right and then the White Point only part of the way to the left until the tones of the image begin to look match your visualization. By experimenting with different settings you can achieve the tonal values that come close to your vision of the scene. Also, it is important to remember that there is still a Curves Adjustment step that will help fine–tune the image.

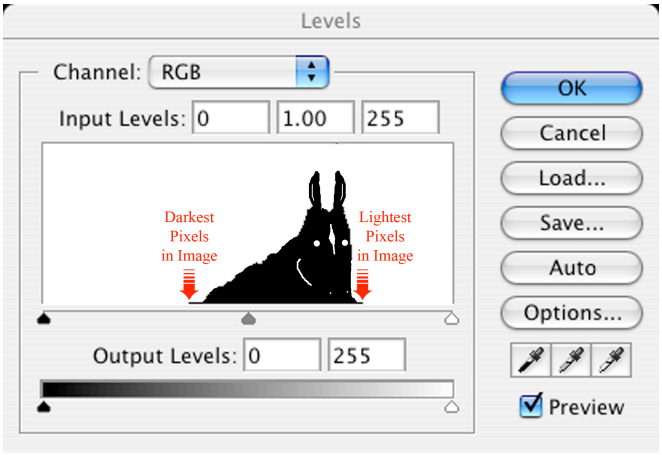

Figure 4.6 Levels Layer Gray Horse in Fog

There is a feature of the Levels Adjustment Black and White point sliders that is very helpful when evaluating settings. When you move either the Black Point or White Point slider, hold down the Option Key on the Mac, (for Windows the Alt key) and move the slider back and forth. The Option Key with the Black Point slider will cause the entire image to turn white. As you move the slider to the right, you get a visual representation of which pixels in the image will be converted to pure black, or Level 0. These areas of the image will show up as White Pixels. Move the slider until you determine just what image detail you wish to assign to Black. I usually want at least a few of the pixels in the image to render pure black—sometimes more, sometimes less, depending upon the image. I find that establishing the Black Point first is very helpful and makes further adjustments much easier. It's like setting an anchor point for the image. For most images, I set the Black Point such that there is an area of pure black, however the shadows retain rich texture.

Now do the same with the White Point Slider. Hold down the Option Key and slide the White Point slider to the left. The entire image will turn Black until you reach the point where you are affecting highlights in the image. Now move the White Point slider back to the right until you reach just the point where there are no Black Pixels, or the only Black Pixels are in specular highlights in the image.

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This may be where you want to set the White Point. Release the Option Key and examine the image to see how it looks. If it seems to have too harsh a relative tonal contrast, then slide the White Point slider a bit to the right. Figure 4.7 shows an original image (middle) with the Black Point Slider/Option Key adjustment on the left and the White Point Slider/Option Key adjustment on the right. These are not the actual adjustments that I would choose, but have been exaggerated to provide enough image detail to show how the feature works.

Now you may have been wondering about the middle slider, the Gray Triangle, that we have not

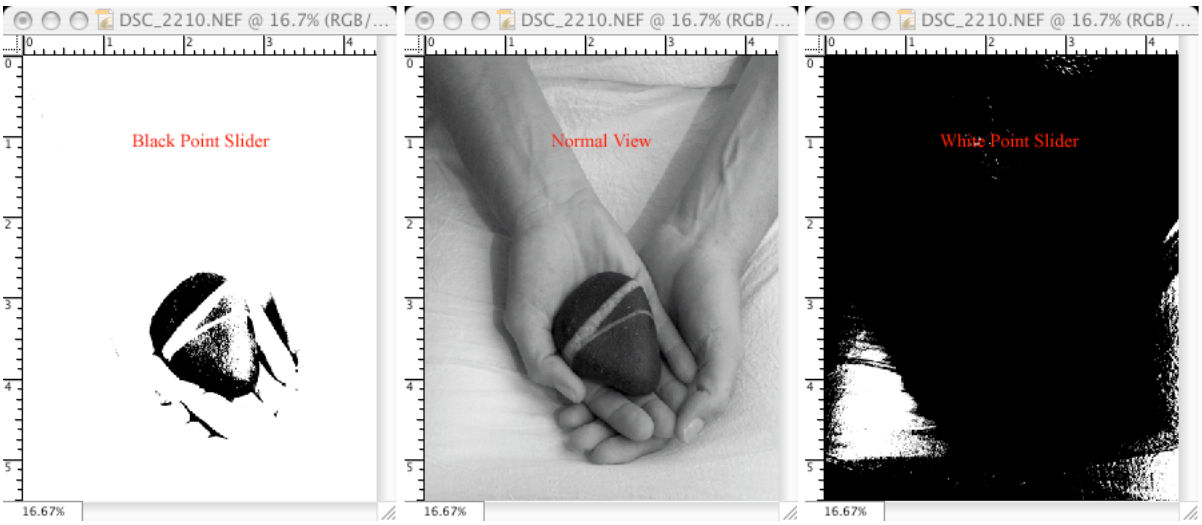

Figure 4.7 Effect of Black & White Sliders with Option Key

touched yet. This slider will make the image darker by sliding it to the right or make all the image lighter by sliding it to the left. This is the Gamma Adjustment and it moves the midpoint gray (level 128) to a different point in the range of image data. I do not like to use this method to adjust the relative tonal values of the image. I prefer to do this with the Curve Adjustment, as shown in the next section.

Here are a couple of tricks that I use this Gray Slider for. If you slide the Gray Slider all the way to the left or all the way to the right, the image will show how your adjustments are affecting the very deep shadows and the very light highlights. Figure 4.8 shows an image with the Gray Slider moved all the way to the left. This will sometimes show some very ugly noise, dust, or other anomalies that you were not aware of. This is a good time to drag out the Healing Brush and fix any problems like this, because though these defects may not be that apparent on your monitor, they have a nasty habit of rearing their ugly heads in the final print. You can leave the Gray Slider where it is, hit the OK Button and then perform the cleanup. After you are finished with the cleanup, you can open this Levels Adjustment Layer and move the Gray Slider back to the central, neutral position (1.0).

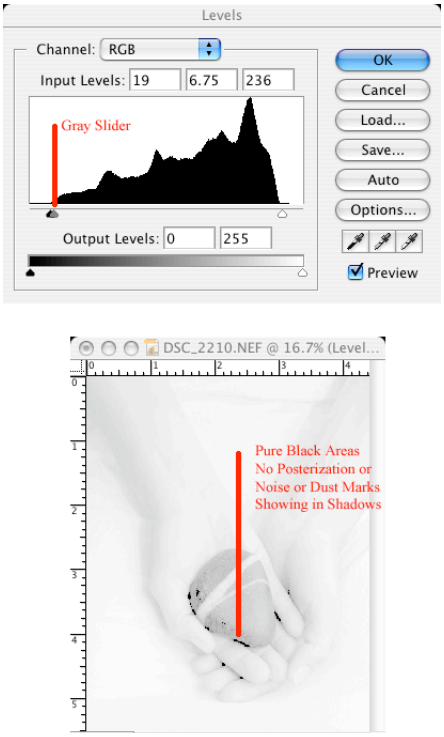

Figure 4.8 The Gray Slider

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The second trick with the Gray Slider is to look for posterization or other tonal variations in the deep shadows and bright highlights, again by sliding it all the way to the left as shown in Figure 4.8. If the Capture Phase produced any anomalies that might be problematic in these tonal areas you need to know this and determine if they will be an issue when making your print. An example of a problematic situation would be trying to print such a negative with a very low contrast mix of Palladium where the extremely long tonal range of the print will open up the shadows to a degree that these anomalies become very apparent in the final print.

This method of setting the Black and White points should bring the image close to what you are looking for, but it won't be perfect yet. The midtones may not have quite the separation you want or you may desire a slightly different look in the relative tonality of the overall image. This adjustment should be achieved in the next section with the Curves Adjustment Layer.

Curves Adjustment Layer

Now that the range of tones has been defined by the Levels Adjustment, the Curves Adjustment Layer can be used to adjust the relative tonality of the image. By using the Curves Adjustment in a Layer, you can always go back and tweak it whenever you wish since the change is not permanent. I like to also have the Info Palette open while making this adjustment, just as when using the Levels Adjustment. With the Info Palette, using the Color Sampler Tool, you can define up to four critical points on the image with Samplers, which will give you constant feedback regarding how the curve changes being made are affecting the tones in those areas of the image.

Follow the steps below:

1. Open the Info Palette and move it to the side of the image.
2. Add Sampler Points to the critical areas of the image using the Color Sampler Tool.
3. Create an adjustment layer for Curves (*Layer>New Adjustment Layer>Curves*) and move it to the side of the image.

Now the Layers Palette should look like Figure 4.9. Notice in Figure 4.10 that I have the Curves Grid set to 10 x 10 rather than 4 x 4—you toggle this by Option Clicking on the grid (Alt Clicking with Windows). I also have the Grid set so the shadows are in the lower left and the highlights are in the upper right. Clicking on the small gradient, just below the Grid, toggles this feature. This also changes the tonal values to be displayed in levels (0–255) rather than percentages.

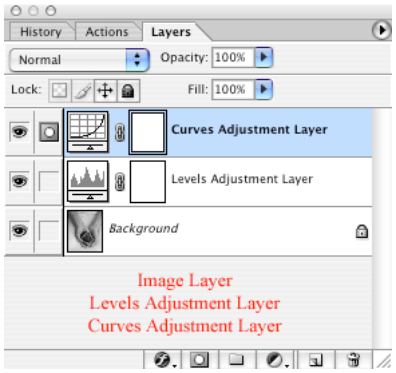

Figure 4.9 Layers Palette

Here you really want to take your time and tweak the image slowly until you are satisfied with the tonal relationships of the image. I like to start building my adjustment curve by adding two points, one in the shadows and one in the highlights. Click on the Curves Adjustment Window to make it active and then move the cursor over the image. Notice the cursor has turned into an eyedropper. Hold down the mouse button and as you move over the image, the eyedropper samples the tones and a small circle will move up and down the Curve indicating the location of the sample point on the curve. If you wish to establish a shadow point on the curve, move to a shadow area and Command/Click on a Mac (Control/Click in Windows) to add that point to the curve.

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The point that was just added is the current active point on the curve. The Input and Output values (initially the same) are shown in the boxes in the lower left hand corner of the Curves Adjustment Window. To adjust this new point in the shadows, use the Up Arrow and Down Arrow keys. This will allow you to nudge the point up and down very accurately.

Add a point on the curve to adjust a critical area in the highlights and in the midtones. You can add up to 14 adjustment points to this curve. As your eye gets better, you may find yourself adding more points. However, it isn't always necessary to use all 14 points to get a good Curves Adjustment.

Figure 4.10 shows an image with the Curves Adjustment Layer and the Info Palette displayed. The Info Palette allows you to set up to four Sampling Points at critical places on the image. After doing this, you can set points on the curve that match the location of these points. Notice the corresponding point #1 on the Curve and Sampling Point #1 on the Info Palette and the image.

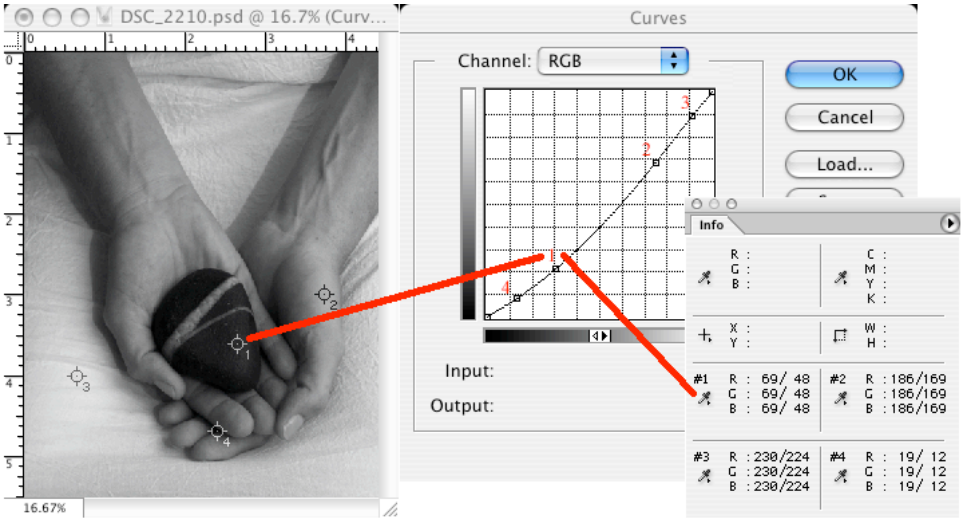

Figure 4.10 Point Samples Matched to Curve Points

Of course these are only example curves and you may end up with a curve that looks like two of these curves combined. There is a tendency to over correct with the Curves Adjustment when first starting out. Getting it right takes some practice and experience. I find that it is helpful when adjusting a point to keep my eye on the image, not on the curve. By moving the point back and forth with large adjustments at first and then making smaller and smaller back and forth adjustments, you will come to a position for that adjustment point that looks right. Eventually you will reach a point where these adjustments seem to *snap* the image tones into place and you feel they are just right. The beauty of the Curves Adjustment Layer is that you can always come back and change the adjustment later.

Now sit back and look at the image. How does it look? Study it for a while. Slowly you will begin to see things you would like to adjust—mostly in local areas of the image. This is where you can really begin to make your image sing with local tonal adjustments.

This is also a good point to save the image and then open a copy for the next stage of work. Up until now, all the changes to the file, except for the small amount of recovery sharpening and cleanup, have been non–destructive changes. This means that the changes have been in the form of Adjustment Layers that can be deleted or changed. The next changes will actually alter the file, so it is good to have a copy that you can go back to should the next adjustments go awry.

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Local Tonal Adjustments

Local tonal adjustments are tonal adjustments made to just one area of an image, just as one would burn and dodge a print in a traditional darkroom. Your inspection of the image, after completing the Curves Adjustment Layer, may indicate that some highlights need to be burned in, some shadows need to be dodged, or the edges need to be darkened. Any of these adjustments can be easily accomplished by using the History Brush in combination with either the Levels Adjustment or the Curves Adjustment. Remember though, the technique described below alters the basic image file and once the file is saved, the changes cannot be reversed.

Perhaps you wish to burn in an area of an image to get more texture in the highlights and to tone down the highlights as is needed in the image shown in Figure 4.11.

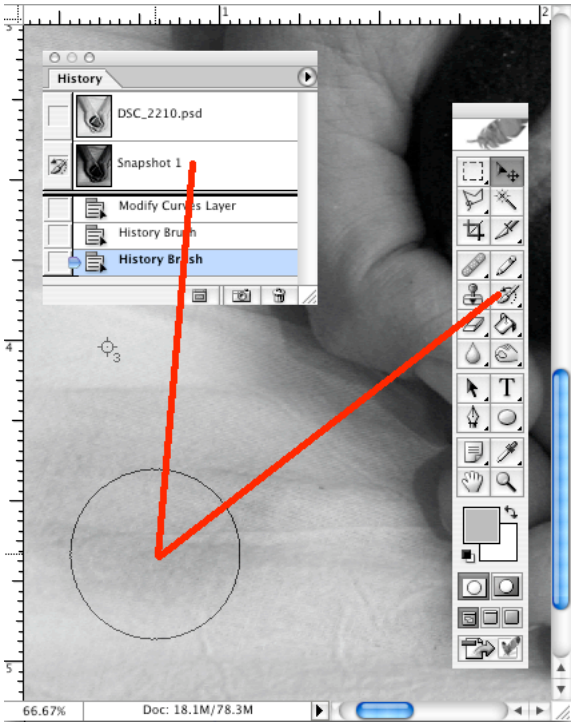

Figure 4.11 History Brush Burning In

The first step is to adjust the image so the highlight area of the image shows the tonality and texture you desire using the Curves Adjustment (*Image>Adjustments>Curves*). Using the Curves Eyedropper Tool, Command/Click on the area of the image that you wish to adjust. This will place an adjustment point on the curve for that tonal value. Use the Down Arrow Key to adjust the highlight until it has the tone/texture you desire. Click the OK Button. Next, using the History Palette, take a Snapshot of the image. Next undo the Curves Adjustment (*Edit>Undo*).

Select the History Brush and set the Brush Size to a convenient size and the Tool Opacity to 25%. Set the Snapshot of the image that you just created as the source for the History Brush. Now you can paint in the tonal adjustment of the highlight area with the History Brush.

When using the History Brush with the Opacity set at a value below 100%, such as 25% in this example, 25% of the Curves Adjustment is applied first time you go over the area. To apply an additional amount of the Curves Adjustment change from the Snapshot, the mouse button must be released and then clicked again when going over the same area.

You can use the same steps to adjust a local shadow area of an image that needs to be opened up more. In this case, after sampling a point in the shadows to get an adjustment point on the curve, the point on the Curves Adjustment would be nudged up with the Up Arrow Key until the shadow area is opened up sufficiently. The History Brush would then be used to paint in lighter tones in the shadows.

Local Sharpening

Local sharpening can be accomplished in the same manner as Dodging and Burning with the History Brush. This allows you to emphasize a portion of the image you wish to draw the eye to by making the detail in that area more crisp.

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First display the area of the image you wish to sharpen at 100%. Next, open the History Palette and make sure it is to the side, out of the way. Using the Unsharp Mask Filter (*Filter>Sharpen>Unsharp Mask),* adjust until the area you wish to sharpen looks right to you. Click OK. Now Click on the Camera Icon in the History Palette to take a Snapshot. Select the History Brush Tool from the Tool Palette and Click on the Snapshot you just made to make it the History Brush Source. Set the Opacity of the History Brush to 25%. Now choose a brush size that fits well with the area you wish to apply local sharpening. Brush in the sharpening with a series of strokes. Each time you go over the area it will apply additional sharpening, just as if you were painting it on with a paintbrush.

Final Evaluation of Tonal Integrity

Now look at the image again. It should look good to you now. This is a good point to check to see what has happened to the tones in your image while you have been working on it. Go to the Layers Palette and open the Levels Adjustment Layer. How does the Histogram Look Now? Do the Endpoints seem to still be set properly? Try the trick of sliding the Gray Triangle (Middle Gray Adjustment) all the way to the left and all the way to the right to examine the deep shadows and the highlights. Do they look smooth? No posterization?

If you have worked an image file so much that it begins to lose the rich tonal values you started with, delete it and start over. One sure indication you should start over is if the image histogram resembles a comb with broken teeth or a molting porcupine.

Does the Curves Adjustment Layer need a final tweaking? Invert the file and examine the entire file in its negative state. Look for any problems that were lurking in the shadows. If all looks OK, invert the image back to the positive state.

If the image looks great, save the file!

Final Output Sharpening

Remember I mentioned that sharpening should be done in three stages? So far you have applied a small amount of global sharpening to restore image sharpness lost in the capture process. You have also applied some local sharpening in areas needing emphasis. The final sharpening, using one of the more complex sharpening techniques, such as High Pass Sharpening, should only be applied when you print the negative. This step of sharpening should be applied *temporarily* only after the output size of the image has been determined. This type of sharpening is dependant upon the final dimensions of the print and should be done carefully so that the image does not have the unsightly halo affect that makes people point and shriek *Digital!* like the zombies in *The Puppet Masters*. Bruce Fraser describes a 3 stage method of sharpening on his website at www.pixelboy.com.

Before using High Pass Sharpening, resize the image to the final output size and save it under a new name. When resizing the image, use one of the bicubic methods of resampling. Photoshop CS added two new versions of bicubic resampling, Bicubic Sharper for making images smaller and Bicubic Smoother for making images larger.

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Open the Layers Palette and select the layer that contains your image. Duplicate this layer and name it HighPass. With this new layer selected, apply the High Pass Filter to the layer (*Filter>Other>High Pass*). There is one setting to make in the window for the High Pass Filter. Set the Radius to a value of around 10 or 11 as shown in Figure 4.12. This is a starting point, you can experiment later with different values to see what seems to work best for you.

Click the OK Button.

After the filter has been applied, you will see a very strange looking version of your image. Don't worry—you aren't done yet. Select this layer in the Layers Palette and using the Pop Up selection to change the mode from Normal to Soft Light. Now you are able to see the original image layer through the sharpening mask you have just created. Toggle the High Pass layer off and on and you will see the sharpening affect.

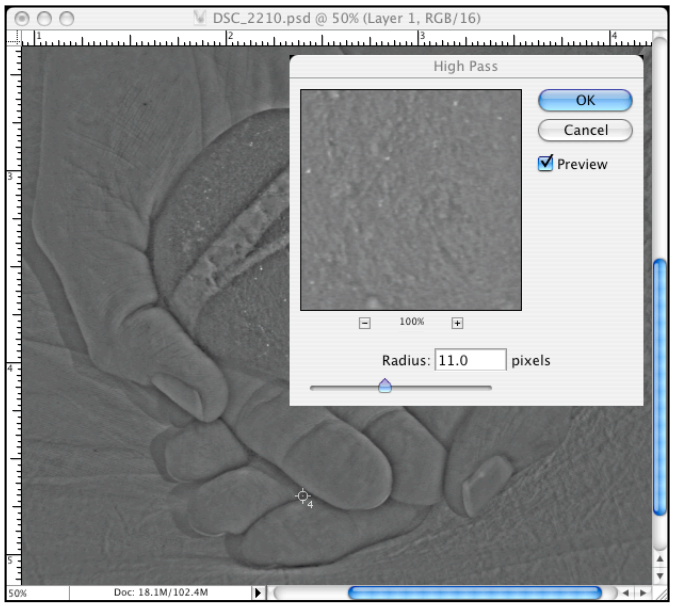

Figure 4.12 High Pass Sharpening Layer

Next pick a critical area of the image with detail and view it at 100%. Toggle the High Pass Sharpening Layer off and on. If the affect is too much, use the Opacity Layer and slide it back and forth between 20% and 100%. When you reach a point that looks just right, stop. Try to avoid a setting that causes those nasty halos around the very fine detail.

If there are areas of the image you do not want to be affected by the High Pass Sharpening Level, you can erase those areas of the sharpening mask with the Erasure Tool. This is sometimes helpful in larger areas of smooth tones where sharpening is not really necessary, as the sharpening might exaggerate the grain.

Next view the image at 50% and 100%. At each view, toggle the sharpening layer off and on. See if it looks right to you at both magnifications. The 50% magnification will give you a better impression of how the image will look when printed. If it appears to be over–sharpened, reduce the opacity of the High Pass Sharpening Layer until it looks right. Save the image.

If you are done with the image and ready to make a negative, merge the High Pass Sharpening Layer down (*Layers>Merge Down*).

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IMAGE FILE CONSISTENCY

This completes the adjustment of the image prior to creating a digital negative. Once you have enough experience at image file preparation, you will reach a point where you become very consistent and can visualize how the image will print with your process. The image histogram is always a very good tool for analyzing the tonality of an image. A full, rich histogram, unless your image is a gray horse in the fog, is the key to a good final print.

A fairly good method of proofing prints is to print with black ink only on Epson Luster paper using the printer setup described in this book.

If you are fairly confident that you are adjusting your images properly as they appear on your monitor, yet you are not quite satisfied with how they are printing with your alternative process, try to avoid the temptation to fiddle with each image file until you get a good print. This method leads to a lot of prints being used for placemats. Fiddling with image files is not a consistent means of adjustment. It is better to use an adjustment in chemistry, Process Adjustment Curve, or a secondary tweaker curve that you can incorporate in your standard workflow. If you are finding that your prints need a lot of tweaking, then you need to review your calibration process and perhaps, do it again.

Part 2
The Precision Digital Negative System

Lotus Leaf —m nelson © 2004

Mysteries lie all around us, even in the most familiar things, waiting only to be perceived.
—Wynn Bullock

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CHAPTER V: THE PRECISION DIGITAL NEGATIVES PROCESS

Before you leap into the world of digital negatives, there are a few good reasons why it is important to think about the characteristics of the alternative photographic process you wish to use with this system. Doing so will help you make better decisions in developing your workflow.

WHY DIGITAL NEGATIVES OFTEN FAIL

There are a variety of reasons why digital negatives fail to provide a good print. Here are the four primary reasons:

1. The Density Range of the inkjet negative does not match the Exposure Scale of the alternative process. There is a great deal of literature regarding adjusting the Density Range of standard in-camera negatives or wet process internegatives to match the Exposure Scale of alternative processes. Until now, standard practice with digital negatives has been to compensate for this mismatch with the Process Adjustment Curve. Figure 5.1 illustrates the two common cases of mismatch in this relationship between negative Density Range and print Exposure Scale. The curve required to correct for too high a Density Range can be so extreme that there is a large loss of tonal information in the final print. If the Density Range of the negative is too low, the highlights of the image will print too dark and paper white will be impossible to achieve. If the Density Range of the digital negative is adjusted to precisely fit the Exposure Scale of the alternative process, the only requirement for the Process Adjustment Curve is to adjust the relative densities of the negative to match the natural curve of the process.

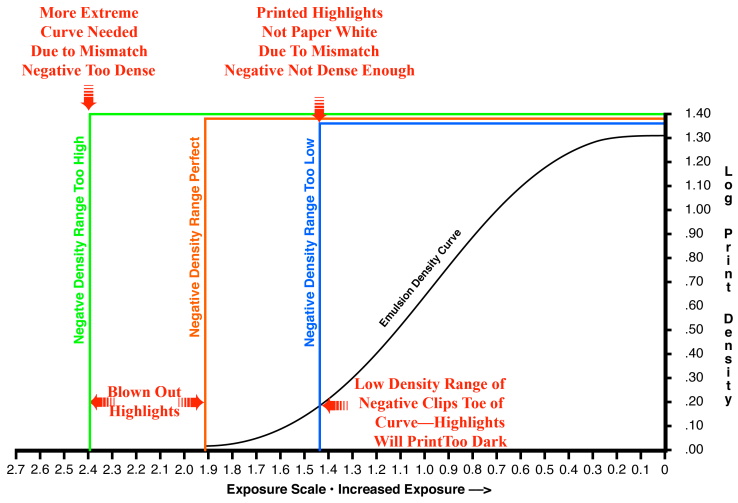
More Extreme Curve Needed Due to Mismatch Negative Too Dense
Printed Highlights Not Paper White Due To Mismatch Negative Not Dense Enough
Negative Density Range Too High
Negative Density Range Perfect
Negative Density Range Too Low
Emulsion Density Curve
Blown Out Highlights
Low Density Range of Negative Clips Toe of Curve—Highlights Will PrintToo Dark
2.7 2.6 2.5 2.4 2.3 2.2 2.1 2.0 1.9 1.8 1.7 1.6 1.5 1.4 1.3 1.2 1.1 1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0
Exposure Scale • Increased Exposure —>
1.40 1.30 1.20 1.10 1.00 .90 .80 .70 .60 .50 .40 .30 .20 .10 .00
Log Print Density

Figure 5.1 Negative Density Range Matched To Exposure Scale

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2. The use of an adjustment curve of unknown origin is another cause for print failure. There is rarely any information available regarding the variables which shaped the adjustment curve for a given process, such as contrast mix, light source, paper, humidity, exposure values, coating methods, development methods, etc. The chances that your workflow would exactly match that of the person who developed the curve are slim to none.
3. The original image file contains digital artifacts that show up in the print and are distracting to the viewer. This is often due to overworking an image file, such as applying a series of Levels Adjustments and Curve Adjustments instead of just one of each. One of the greatest culprits is over-sharpening, which produces a halo effect around detail in the image—perhaps fine when sharpening angels, but otherwise not considered a good workflow habit.
4. The Image File Capture and Image File Preparation phases fail to produce an image with good rich tonal values.

There are a number of other issues that can hinder the process of making a really good digital negative, but these are the most prominent. Later chapters of this book will provide workflow solutions that will eliminate or at least drastically reduce these problems.

How The Precision Digital Negative Process Works

If you are currently printing with digital negatives, or are considering doing so, you should find this system extremely helpful. I think I can safely say that the methods I have developed will give you more control than ever before possible—thus allow you to make a print that is superior to what has been standard practice up until now. These skills give you freedom to create and print images that match your vision.

Of the information presented, there are three basic concepts that I consider the most important to understand:

1. Negatives made with color output devices, such as inkjet printers and high end imaging devices using color film, can be rendered such that they function in a very different manner than traditional negatives or imagesetter negatives. These negatives, when properly produced, function as translucent light filters, rather than blocking light as does an imagesetter negative or a traditional in–camera negative.

2. The density range of digital negatives produced with color capable output devices can be precisely controlled prior to the application of the Process Adjustment Curve by determining a Standard Color Density. This is a key factor in taking control of the process. I refer to this means of controlling negative density range as Color Density Range Control[patent pending]. Color Density Range Control[patent pending] is extremely important in the crafting of digital negatives because it tailors the negative to the specific contrast requirements or Exposure Scale of the chemistry of the alternative process used.

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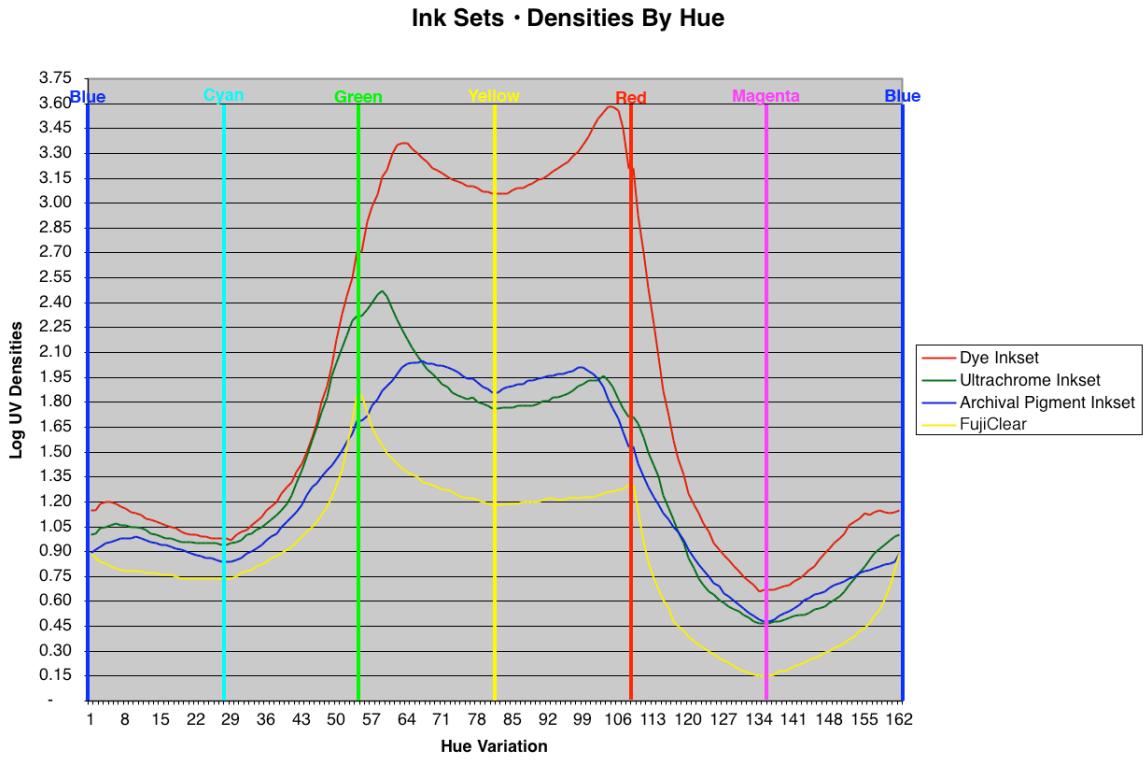

Figure 5.2 Color Density Range Signatures of Three Ink Sets and FujiClear

3. The densest part of the negative, where it achieves Dmax, can be matched exactly with the process contrast mixture such that the combination prints exactly at paper white. Figure 5.2 illustrates the possible ranges or DMax values for three popular ink sets and FujiClear Film. The vertical colored lines indicate points on the x-axis where the hue shifts from Blue>Cyan>Green>Yellow>Red>Magenta>Blue. In other words, by varying the overall color or hue of the negative, the Dmax of the negative is matched to the end of the toe of the emulsion's curve. There is a great advantage to using Color Density Range Control[patent pending] —it relieves the Process Adjustment Curve of the burden of adjusting for the mismatch between the tonal range of the negative and the Exposure Scale of the alternative process. This leaves only one requirement for the Process Adjustment Curve—adjustment of the relative tonal values of the negative between DMin and Dmax. This produces a much less extreme Process Adjustment Curve that will preserve more of the tones of the image file. Previously the Process Adjustment Curve alone has been used to account for the density range adjustments of digital negatives.

4. The primary variables that you can manipulate when printing alternative processes with digital negatives are:

    - The Contrast of the Chemistry (with many alternative processes)
    - The Standard Exposure Time
    - The Density Range of the Negative
    - The Process Adjustment Curve

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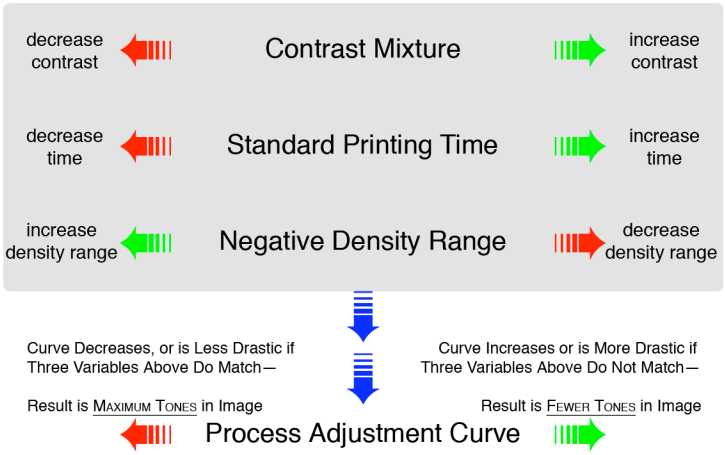
decrease contrast
Contrast Mixture
increase contrast
decrease time
Standard Printing Time
increase time
increase density range
Negative Density Range
decrease density range
Curve Decreases, or is Less Drastic if Three Variables Above Do Match—
Result is Maximum Tones in Image
Curve Increases or is More Drastic if Three Variables Above Do Not Match—
Result is Fewer Tones in Image
Process Adjustment Curve

Figure 5.3 Relationship Between Primary Variables

Once you understand the relationship between these four variables represented in Figure 5.3, you can explore creative manipulation of them and make prints with much better tonality and prints that match your vision for your images.

The Precision Digital Negative Workflow:

1. Decide on an alternative process
2. Decide on a Contrast Mix (if applicable)
3. Determine a Baseline Printing Time for the negative's film substrate and the specific alternative process chemistry you have chosen
4. Determine a Standard Printing Time for the negative's film substrate and the specific alternative process chemistry you have chosen
5. For negatives made with color capable devices, determine an appropriate Standard Color Density by printing the Color Density Range Palette with the process
   (For imagesetter negatives skip #5 and go to #6)
6. For inkjet negatives, print the Tonal Palette on the film substrate using the Standard Color Density
   (For imagesetter, laser and LED negatives, send the Tonal Palette file to the service bureau for printing)
7. Print the negative of the Tonal Palette using the Standard Color Density with the alternative process
8. Determine the Process Adjustment Curve from the printed Tonal Palette
9. Apply the Process Adjustment Curve to the Tonal Palette file

10. For inkjet negatives, create a negative of the Tonal Palette with the Process Adjustment Curve applied
    (For imagesetter negatives, send the file to the service bureau)
11. Print the Tonal Palette with the Process Adjustment Curve applied using the alternative process
12. Make prints using the values you have established with these calibration methods

ADVANTAGES OF THE PRECISION DIGITAL NEGATIVE SYSTEM

There are a number of advantages when using this system for contact printing with alternative processes:

- It works with any alternative process
- It works with any digital output device used to render digital negatives
- It provides a highly accurate method of controlling negative density range that was unobtainable prior to the development of Color Density Range Control[patent pending]
- It minimizes tonal loss in the printed image due to exaggerated curves
- It provides software to derive a custom Process Adjustment Curve that will work with all your images
- It provides well-designed palettes for each of the calibration steps
- It reduces the number of test prints necessary
- It allows you to test the effects of modifying variables in your workflow
- It will continue to work effectively as you change or upgrade your equipment
- It will save you time and the cost of wasted chemicals and prints
- It will provide a good understanding of how digital negatives work
- It will give you a high degree of control over your work
- It provides very repeatable results
- It makes you feel good ☺

I hope this system will help you make better images and give you a feeling of being more in control of the digital tools that you use to make them.

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CHAPTER VI: ALTERNATIVE PHOTOGRAPHIC PROCESSES AND DIGITAL NEGATIVES

Before making a digital negative, it is important to consider some of the characteristics of different alternative processes and how these characteristics might influence the crafting of the negative.

NEGATIVE DENSITY AND ALTERNATIVE PROCESS EXPOSURE SCALE

This is a key issue to consider when planning digital negatives. There are many wonderful alternative photographic processes that one might use to make a print and each one has its own density range requirements for a negative. Some processes have methods for varying contrast through changes in the chemistry or other means. Gelatin Silver printing offers papers in various contrast grades or multigrade papers. Other processes are of a *fixed contrast*. The Precision Digital Negative system can accommodate both types quite easily without depending only on the Process Adjustment Curve to match the Exposure Scale of the alternative process—in fact, as you will see, this is the major strength of the system.

COLOR NEGATIVES & PROCESSES WITH CONTRAST CONTROL

Many of the alternative photographic processes have some method of varying the contrast of the chemistry or lengthening/shortening the Exposure Scale. For example, Platinum/Palladium has a variety of methods of contrast control, such as using chlorate, dichromate, or Na2—any of which can produce very precise variations of the printed tonal scale. The contrast of the Carbon print can be varied with the concentration of the dichromate solution used to sensitize the tissue. If you are using one of these alternative photographic processes with variable contrast capability, then you need to pick a starting contrast mix for the Calibration Process described later in this book. There are a couple of approaches that you can use to do this.

One approach would be to start with a contrast mix in the middle. This would allow you to adjust the chemistry in either direction to find a combination that you like best. Another approach would be to start with your favorite mix because it has characteristics you like or characteristics that facilitate making superior prints.

Another approach would be to start at one end of the continuum, with a contrast mix (Exposure Scale) that gives a long tonal range, and determine a negative density range that will be sufficient to work with it. This approach is one of finding the "limits' of the contrast mix/negative density range combination. An example of this with Palladium would be to start with a mix with a very long tonal scale (minimal restrainer) such as a 1s mixture, and then calibrate to that mix. I prefer this second method, because it provides valuable information regarding the boundaries of the density range requirements of the alternative process and the density range capability of the device used to render the negatives. This is determined during the Calibration Process when printing the Color Density Range Palette.

If the test print of the Color Density Range Palette fails to yield any square or swatch printing paper white, then the Exposure Scale of the chemistry mix is too long for the Color Density Range Potential of the printer's ink set or output device. Should this occur, the Exposure Scale of the process should be reduced by using a slightly higher contrast mix. Reprinting the Color Density Range Palette with this higher contrast mix will indicate if the change in contrast is enough to provide a few squares of paper white with the printed Color Density Range Palette. If not, increase the contrast mix a little more.

A second advantage of this approach of using the longer Exposure Scale (lower contrast mix or lower paper grade) for a process is that there is less likely to be visible *ink grain* or rendering of the droplets of ink that comprise the negative. My tests have shown that higher contrast mixes exaggerate ink grain.

Color Negatives & Processes Without Contrast Control

Processes without contrast control or processes of "unknown contrast" have previously been problematic because the only means of adjusting the negative has been to use the Process Adjustment Curve. This leads to an extreme curve that results in tonal loss in the image. With the calibration method you will learn in this book, the required density range for a negative can be easily determined in one printing. Once this is accomplished, the Process Adjustment Curve will then be less drastic, since it is only being used to adjust for the relative image densities of the negative between DMin and DMax.

Imagesetter Negatives & Processes With Contrast Control

If you wish to use an imagesetter negative with an alternative process that has contrast control, the best approach again is to use a lower contrast mix, which produces the least drastic Process Adjustment Curve to get a proper print.

Imagesetter Negatives & Processes Without Contrast control

If you are going to use imagesetter negatives with an alternative process that has no contrast control, you are limited to using the Process Adjustment Curve alone to match the negative density range to the process Exposure Scale.

Resolution Requirements

Alternative Processes vary in their ability to accommodate very high resolution negatives. For example, Gelatin Silver prints or Platinum/Palladium prints can easily be made with a very high resolution negative. On the other hand, processes such as Gum Bichromate may suffer when printed with such a negative. In the case of Gum Bichromate, if too high a resolution negative is used, the grain of the printed emulsion in the highlights may be too small to adhere to the substrate and thus wash off during development. Alternatively, the shadows may block up more. If this appears to be a problem, then lowering the resolution of the output device may help. For example, an inkjet negative might be printed at 1440 dpi or 720 dpi instead of 2880 dpi.

Negative resolution is also important when making full color prints with Gum or a similar process. Since the image is made up of 3 layers of cyan, magenta, and yellow emulsions, the color rendering of the image may fare better with larger dots of color. The overlapping "dots" of successive printings will tend to mask the dot pattern. In addition, I might speculate that the larger dots of color may be more vivid because smaller dots may merge into a muddied rendering of color.

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Processes With Mechanical Development

When calibrating alternative processes that have a mechanical phase in development it is necessary to try to be consistent in how this is applied to the print. For example, Gum prints are often sprayed with water to facilitate the production of the image during the development process. If this spraying is not done in a consistent manner, then this will affect the calibration process. If automatic development (floating in water without spraying) is an option, more consistent calibration may be achieved.

Toning Images

Toning images may be a factor you wish to account for in the Calibration Process. If it is very repeatable, likely to alter the printed densities of your image, and something you intend to do often, then apply the toning when determining the Standard Printing Time, when printing the Color Density Range Palette and when printing the Tonal Palette. This will then incorporate the toning into the Process Adjustment Curve.

Part 3
Digital Negatives

Lady With Irises —m nelson © 2001

The urge to create, the urge to photograph, comes in part from the deep desire to live with more integrity, to live more in peace with the world, and possibly to help others to do the same.
—Wynn Bullock

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CHAPTER VII: INKJET NEGATIVES

The quality of inkjet printers has greatly improved in recent years, making inkjet printers an excellent choice for rendering high quality digital negatives. Each month the major manufacturers are announcing new printers with smaller picoliter dot sizes and improved capabilities for rendering smooth tones. Once you understand how they work, you can control the output so that the negatives print with little or no digital artifacts.

HOW INKJET NEGATIVES WORK

Inkjet printers are designed to make very good positive prints, not negatives. They use a CMYK model, which employs cyan (C), magenta (M), yellow (Y) and black (K) inks to form colors and tones. In order to print good shadow detail and a dense black, inkjet printers add the black ink to the CMY in the lower tones. This is great for making good inkjet prints, but it is terrible for making good negatives. The black ink does not work the same in negatives as the C, M, or Y inks—it is opaque rather than translucent and has a very high UV density, in some cases over log 4.0. These characteristics of the black ink make it undesirable to use in negatives.

Inkjet negatives and negatives rendered with other color capable digital output devices function in a different manner than imagesetter or conventional film negatives. I tend to think of the combination of film substrate and ink as a new form of film negative. However there is a fundamental difference with this type of negative that can be used to great advantage.

Instead of blocking ultraviolet light with varying levels of opacity, inks, both dye based and pigment based, are translucent and they filter light. As stated above, this is true of all the inks except black. Thus printing negatives without black ink provides a much more controllable negative.

The color filtering affect of inks works in a very predictable and precise manner, which allows you to control the density range of negatives over a broad range to match a variety of alternative process Exposure Scales.

NATIVE RESOLUTION OF INKJET PRINTERS

Inkjet printer technology is rapidly evolving with new printers being released with native resolutions above 2880 and variable dot size down to 1.5 picoliters and below. I am sure this technology will continue to evolve further resulting in even smoother and sharper negative output from these devices. In the Chapter *Pixels & Dots*, the relationship between file resolution in pixels and printer resolution in dots was explained. At this time, the accepted practice is to set the file resolution to 360 ppi and set the printer resolution to the highest possible resolution. This will give the smoothest and sharpest negatives when used with the proper media setting. As inkjet technology advances, I would expect that the standard file resolution will increase above the current 360 ppi.

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Substrate Choices For Inkjet Negatives

There are many clear films that can be used for negative substrates. The most commonly used is Pictorico OHP film. This film is more expensive, but it has some good characteristics:

- It works with most of the printer manufacturers' inks
- It is less likely to cause ink to puddle
- Inks dry quickly
- It has a low dot gain, so it creates sharp images

Some third party inks will not work well with Pictorico OHP film because the ink is not compatible with the coating on the film and will not dry properly. If you find that the ink set you are using does not dry on a particular film, do not waste time and money trying hair dryers or fixative sprays. Find another film that does work. Negatives should come out of the printer dry to the touch.

Films have different ultraviolet densities and this will affect the Standard Printing Time. Pictorico OHP film is on the higher end, with a log UV density of .11 to .15, or about 1/2 a stop in exposure. The Calibration Process of this system is designed to take this into account.

Paper negatives can be used with this system. There will be some loss of accuracy if the paper is not consistent or the oiling of the paper (to make it translucent) is not consistent.

File Preparation for Inkjet Negatives

Files for inkjet negatives should be 16-bit if possible. There is no need to convert files to 8-bit when printing, since Photoshop™ will do this "on the fly" as the file is sent to the printer. The file can be kept in grayscale mode up to the point of creating the negative. At that point, the file should be converted to RGB mode so that the Standard Color Density can be applied. The resolution of the file should be 360 ppi (for current printers).

Inkjet Printer Alignment

Printer alignment is critical to obtaining good inkjet negatives. A printer that is not properly aligned will produce negatives that exhibit banding, less smooth tones, poorer detail and variations in color. The best results in printer alignment will be obtained with the alignment process being run using the substrate or paper that you intend to use with the printer to make negatives. Needless to say, a Nozzle Check should be conducted prior to the head alignment. I find that using a loupe and a light table are very helpful when examining the output from the printer alignment process.

Printer Settings for Inkjet Negatives

There are a million ways you can configure the printer driver. This method avoids using any profiles and provides a more even distribution of ink. Profiles are designed to adjust the ink densities and colors for specific papers. If you apply a profile when printing a negative, a much more severe Process Adjustment Curve will be required when calibrating since the curve has to undo the effect of the profile. In a sense you would be applying a curve to undo a curve.

Inkjet printer drivers do require that you pick a media setting. The better media settings for digital negatives are the ones that lay down more ink and are used for glossy or semi-gloss papers. Usually the media setting for Photo Glossy Papers will lay down the most ink.

The Inkjet Printer Settings Evaluation Palette shown in Figure 7.1 will aid you in determining the best media setting for your printer.

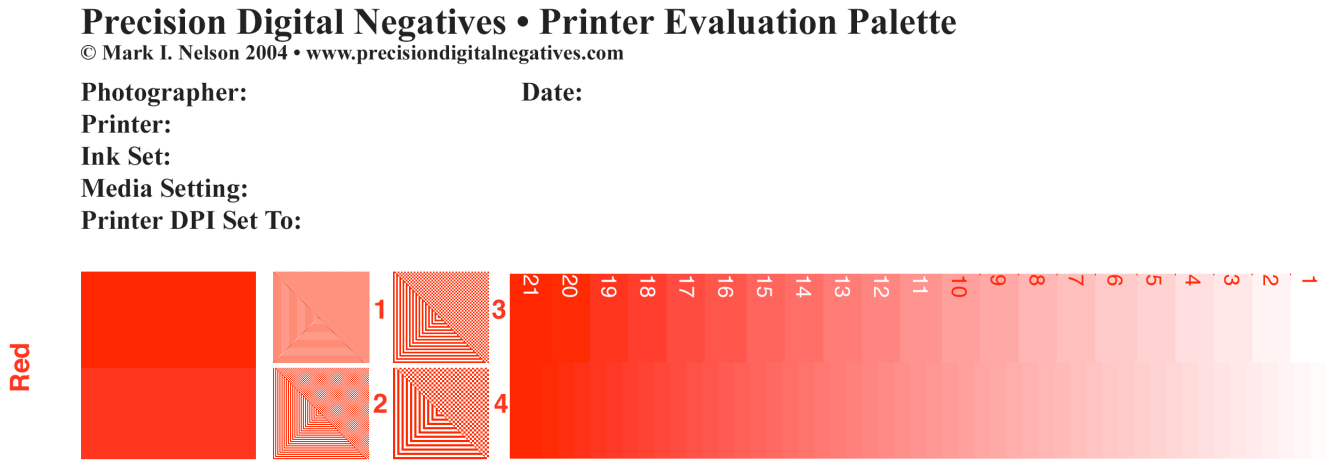

Figure 7.1 Printer Evaluation Palette

The following setup can be used for printing the Printer Evaluation Palette, the Color Density Range Palette, the Tonal Palette and inkjet negatives. The examples are based on an Epson 2200 printer running under Mac OS 10.3 and assume a color working space of Adobe 1998 using Photoshop CS:

1. Make sure the file is in RGB mode (if grayscale, convert to RGB see instructions for negatives regarding when to convert to RGB to avoid problems)
2. From the FILE menu, choose Print With Preview (*File>Print With Preview*)
3. In the Print Window, set *Source Space* to *Document*
4. Set Print Space Profile to *Same As Source*.
5. Click the Print button
6. In the second Print Window that appears, choose the media setting that works best with your printer, such as Premium Semigloss Photo Paper, Premium Luster Photo Paper, or Premium Glossy Photo Paper—Premium Glossy Photo Paper will give the highest density
7. Select *Advanced Settings*
8. Set the printer resolution to the highest available setting, such as 1440 dpi or 2880 dpi (unless the process works better with a lower dpi as previously mentioned)
9. Turn off *High Speed*
10. Now select Color Management and choose *No Color Controls*
11. Now click the Print button and your negative will be printed

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These Print Settings are shown below in Figures 7.2, 7.3, and 7.4.

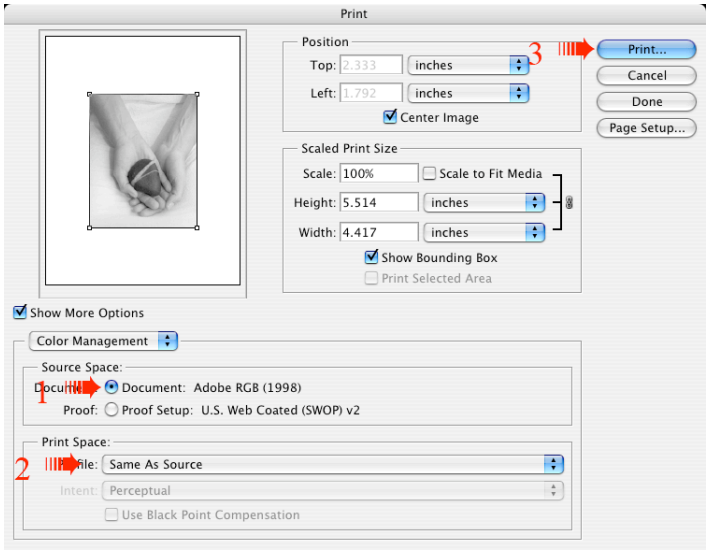

Figure 7.2 Print With Preview Window

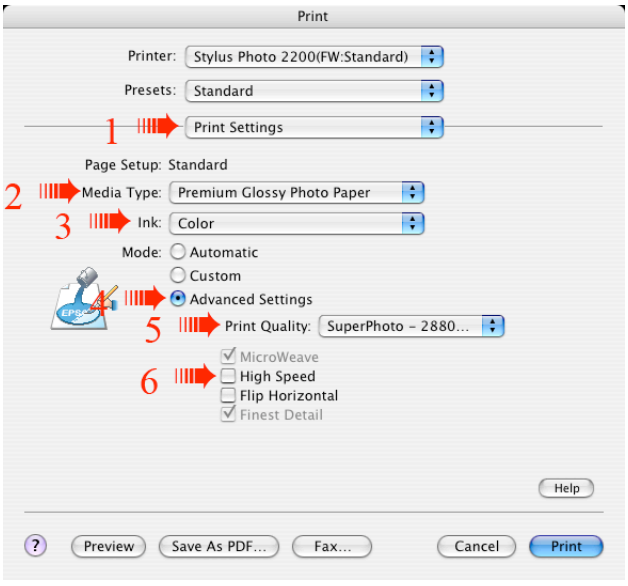

Figure 7.3 Print Settings Window

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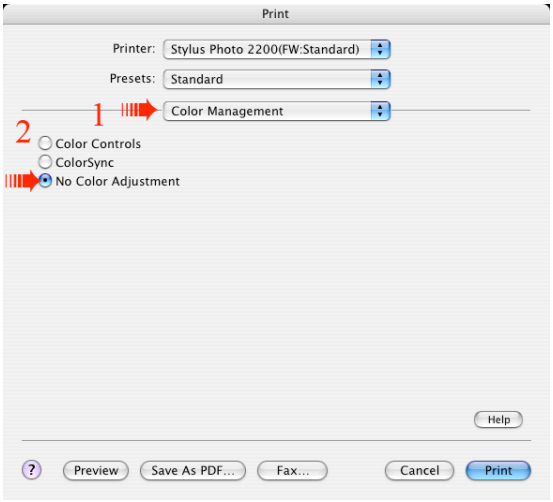

Figure 7.4 Color Management Window

After printing the Printer Evaluation Palette with the different media choices, lay them side-by-side on a light table and examine them with a loupe. Look for evenness in coverage, smoothness in tonal transition, sharpness of detail, and lack of ink puddling. Examine different tonal levels and look for any anomalies such as exaggerated grain or uneven mixing of ink dots. The test image is repeated in Red, Blue, Green, Cyan, Magenta, Yellow and All Inks (though you will not use All Inks to print negatives.) Printing the test image in these ink combinations allows you to evaluate for smoothness, banding, puddling, and sharpness with all possible ink combinations. Pay close attention to Red, Green, Cyan and Magenta, since these colors will most likely be used for Standard Color Densities. Pick the best media setting.

It is likely that the settings will each lay down slightly different densities of ink. During the Calibration Process, you may need to substitute a different media setting such as Premium Glossy Photo Paper to achieve a higher density should the Color Density Range Palette not print any squares or swatches at paper white. Printers using dye inks might require using the Semigloss or Luster media settings to reduce density.

The 4 Checkerboard Grids are 1, 2, 3, and 4-pixel resolution. These grids are good for testing the ability to render fine detail and printer alignment.

CURING INKJET NEGATIVES

It is important to note that though inkjet negatives may feel dry to the touch when they emerge from the printer, they must have at least a couple hours to dry or cure after they are printed. Densities can vary drastically during this time, so be patient and plan ahead. I often print my negatives the day before I make my prints. The same holds true for printing the Color Density Range Palette and the Tonal Palettes during the calibration process.

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Ink Sets & Density

There are a variety of ink sets used with inkjet printers. Usually they fall into two categories, dye based inks and pigment based inks. Pigment inks are popular because they are more archival, but the trade–off is that they are not as vibrant as the dye based inks and do not tend to give the deepest blacks with inkjet prints. On the other hand, dye based inks are more fugitive and thus tend to fade more quickly. These issues, while important when making inkjet prints, are of little consequence when making digital negatives. However, there is a major difference between the two types of inks when calibrating them.

Dye based inks, in general, will have more ultraviolet density than pigment based inks. In some cases this difference can be amount to more than log 2.0 density. Fortunately, this difference can be minimized by the use of Color Density Range Control[pantent pending]—to a great advantage.

Figure 7.5 is a chart comparing the Ultraviolet densities of three ink sets from a popular printer manufacturer—dye, Ultrachrome and archival pigment. The charts show approximate ultraviolet light transmission densities as measured on Pictorico OHP film. It should be noted that three different models of printers from the same manufacturer were used to print the test targets and each test target was printed with identical driver and media settings.

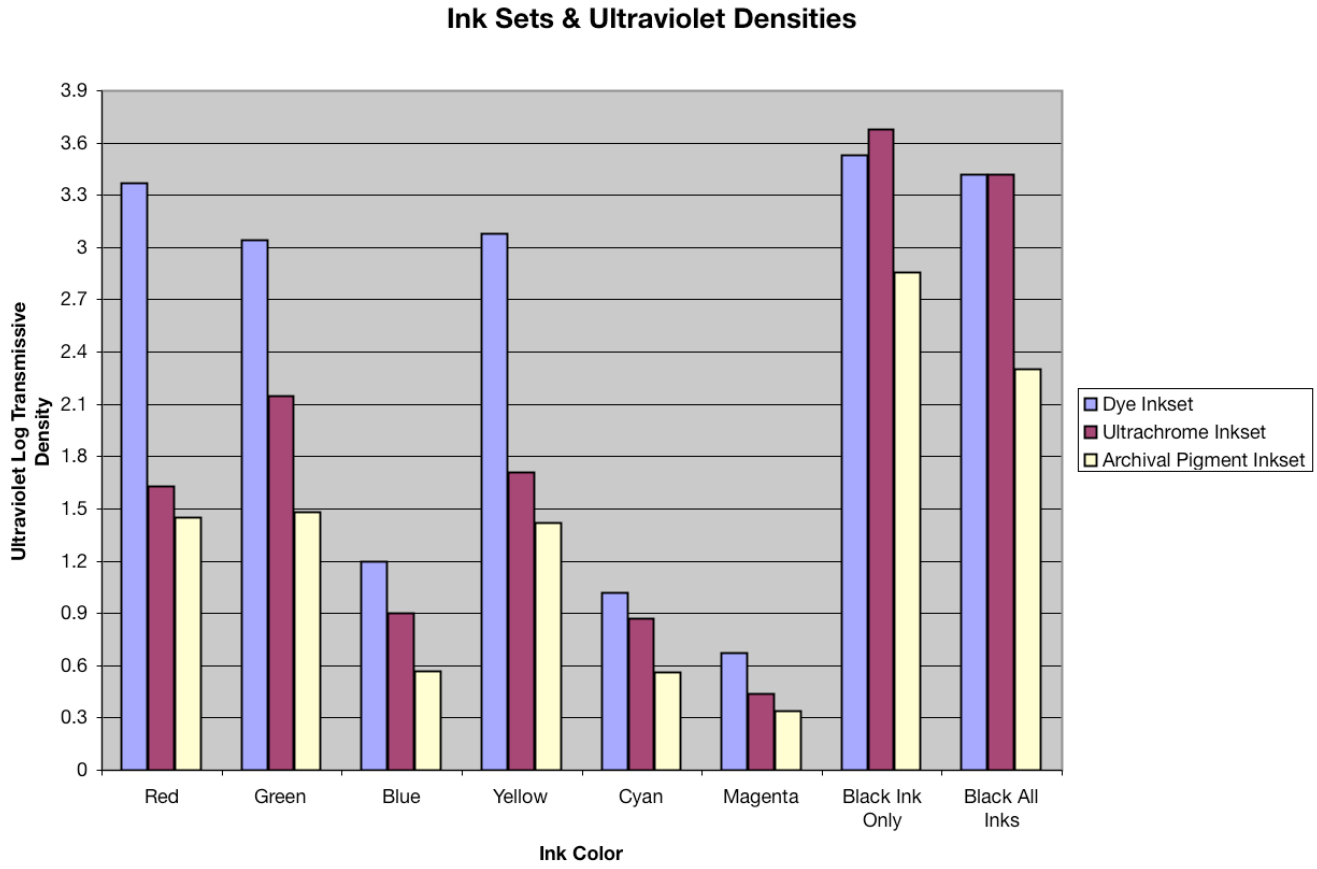

Figure 7.5 Ultraviolet Densities of Three Ink Sets

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The variation of density between ink sets shown by these charts explains one of the problems people have using curves generated by other photographers. If the curve was derived using a different printer/ink set combination, the curve would be invalid for your printer, let alone your workflow. The Dye ink set shows a relatively high amount of density compared to the other two ink sets. This explains why a number of people have reported difficulties when trying to render digital negatives with printers using a dye ink set.

The method of printing a grayscale negative using either Black Ink Only or All Inks obviously provides a negative with a very high density range—more than most alternative processes could accommodate unless the negative densities are highly adjusted with a curve. The high degree of adjustment required to reduce the densities of such a negative would result in a pretty drastic curve—one resembling a boa constrictor with irritable bowel syndrome. Curves this drastic are very destructive to the tones within the image file and result in prints with poor tonal separation and posterization.

The ultraviolet densities of the colors in the chart indicate the possibility of negatives of a lower density range, which would more easily accommodate an alternative process—and would not require such heavy curve adjustment.

Figure 7.6 provides a more detailed look at the ultraviolet densities of a single ink set. The ink colors used include only combinations of cyan, magenta, or yellow inks. Except for three points on the right end of each chart (pure C, M, or Y), the values include a mix of only two inks. No black ink is used. The ultraviolet densities change as the colors and ratios of the two inks change. The three points on the left are pure Red, Green, and Blue. Notice that the lines cross each other such that there are often two ink combinations that will give the same density.

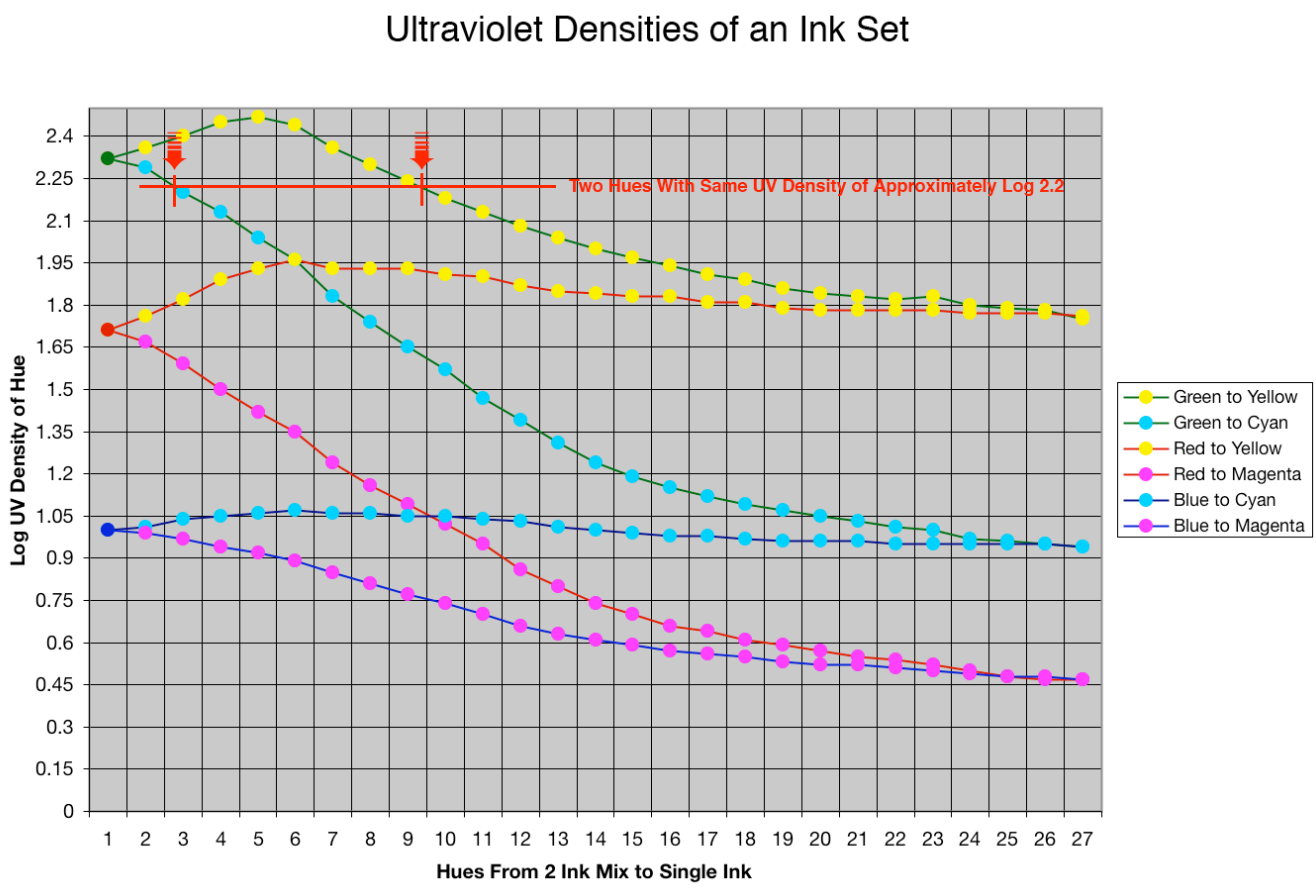

Figure 7.6 Ultraviolet Log Density Signature of Ink Set

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Each point on the graphs represents a color that can be used for a negative. The values shown would be the DMax of any such negative. As this chart indicates, the density range of a negative can be varied quite accurately in very small, precise increments to match the Exposure Scale of an alternative photographic process. In the case of alternative processes such as Platinum and Palladium, which have a high degree of contrast control, a negative density range can be matched to any contrast mix used.

Color Density Range Control[patent pending] is the heart of the Precision Digital Negative System.

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CHAPTER VIII: LASER AND LED NEGATIVES

Laser and LED devices are the most high tech devices available for making negatives. They use either RGB lasers or LED's to image on paper or film. With the right machine, the right service bureau, and proper calibration, these devices are capable of producing the finest, most durable negatives available. They are, however, more expensive. The cost per negative can be reduced by ganging up a number of negatives in a single image file.

HOW LASER AND LED NEGATIVES WORK

The films these devices print on has a very thick (7 mil), durable base because they are designed for backlight displays. They produce negatives very similar to color inkjet negatives with a couple of exceptions. These films are true continuous tone films that are exposed by laser or LED light and then processed in developer. Thus the negatives are quite similar to in–camera negatives, except they have the added advantage of being capable of Color Density Range Control[patent pending]. Color Density Range Control[patent pending] works just as well with these films as it does with inkjet negatives. Laser and LED negatives, when properly produced, function as color filters just as the inkjet negatives. Figure 8.1 shows the Color Density Range Signature of FujiClear adjusted to minus base plus fog of log .70.

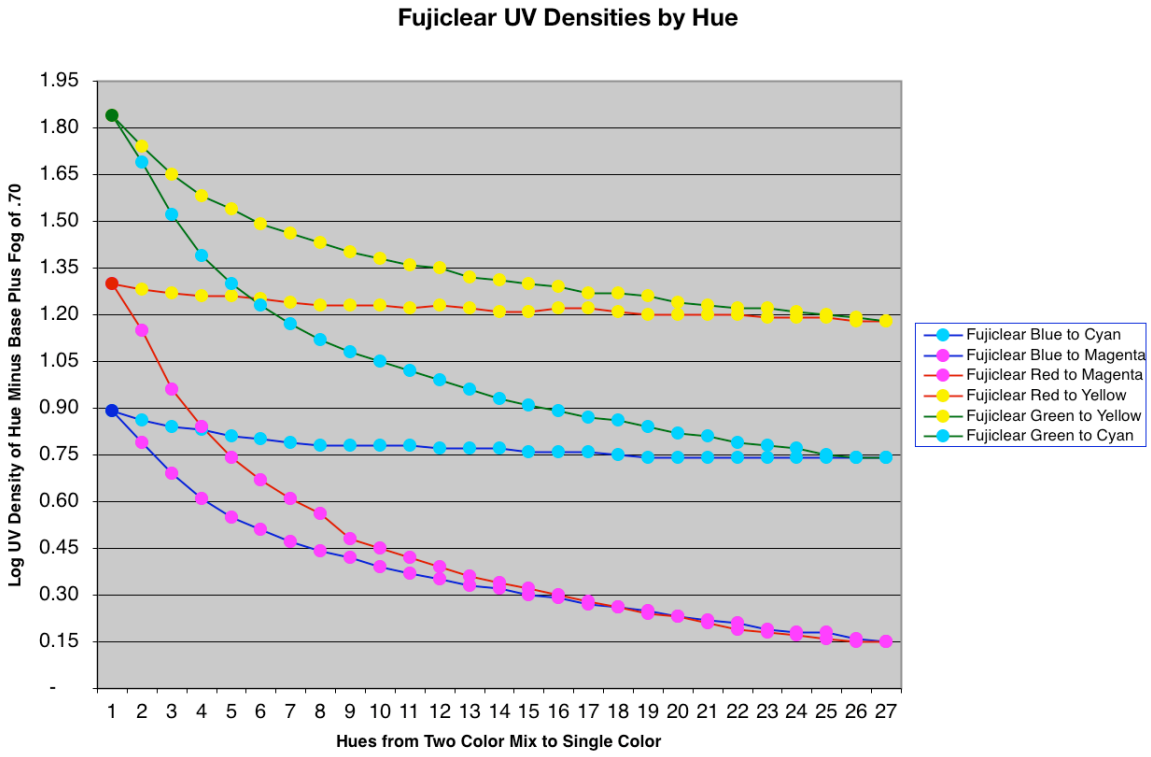

Figure 8.1 Ultraviolet Log Density Signature of FujiClear—Shown Densities Are Minus Base+Fog of Log .70

Notice that the shape of the Fujiclear signature is similar to the signature of the ink set shown in Figure 7.5.

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Native Resolution of Laser & LED Printers

The native resolution of these devices is predominately 300 dpi. This resolution sounds very low compared to inkjet printers and imagesetters, however, they work far better than this would lead you to believe. This is because these devices do not require a dither pattern of dots to render a pixel in an image file. They have a one–to–one ratio between image file pixels and printed dots. This is how they achieve the appearance of continuous tone on film. Thus their "true" apparent resolution is very competitive with inkjet printers and imagesetters. Be prepared for the possibility of a protracted discussion with the service bureau regarding what constitutes the optimum file resolution for their machine. A common response is "anything between 150 ppi and 300 ppi," which is not helpful. A good service bureau knows the answer to this question. It is very important that you size your files properly to get optimum detail in your prints. You may do a better job at this in Photoshop™ rather than leaving it up to the service bureau's software to interpolate the file for you during printing.

Substrate Choices For Laser & LED Printers

There are two types of backlight films for these devices that are manufactured by various companies. The names of the films usually end in either "trans" or "clear"—sort of a generic tag that the companies all adhere to. The most commonly known are versions by Kodak, DuraClear™ and DuraTrans™; Fuji, FujiTrans™ and FujiClear™; and Agfa, AgfaClear™ and AgfaTrans™. The products ending with "clear" will have a clear base and will have a very high ultraviolet blocking characteristic of about log .70–.95 UV transmission density. The products ending with "trans" will have a white base and will have an even higher ultraviolet blocking characteristic of about log 1.5. This ultraviolet screening characteristic is designed to keep the display signs from fading. Unfortunately, it also makes them difficult to use for many alternative photographic processes that depend upon ultraviolet light exposure—exposure times become very long. They can be used with alternative processes, such as Palladium with minimal restrainer. This will keep the printing time within reason and avoid reciprocity failure issues. They do make excellent negatives for most gelatin silver papers, since the printing times remain fairly short.

File Preparation for Laser & LED Negatives

File preparation for outputting negatives with these devices is the same as for inkjet negatives, with a few exceptions:

- Service bureaus will usually ask that files be sent as 8-bit color TIFF files.
- Image print maximum size is about 50" x 50".
- The optimum file resolution is the same as the native output resolution of the device, usually 300 ppi.

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Service Bureau Standards For Calibration & Chemistry

There are two issues that should be checked out with the service bureau. The first is the alignment calibration of the machine. If the machine is not calibrated properly, the negative will display some anomalies such as streaking or moiré patterns. You can test the alignment by including the Sharpness Grid and the Smooth Gradient (included with this system) in the file you send. If the machine is not properly aligned, the two pixel checkerboard will not print sharply. One of the causes of misalignment is failure to re–calibrate the machine when switching to a medium with a different thickness.

The second issue to check is the service bureau's standards for maintaining fresh chemistry for film development. If the negative colors look dull and the light areas don't look bright and clean, then the chemistry used to develop the film was probably old.

If you receive a negative that exhibits either of these problems, you should contact the service bureau immediately and ask that the negative be run again with the problem corrected.

Not all service bureaus with Laser/LED imaging devices will print on FujiClear™, DuraClear™ or AgfaClear. These are specialty products used more by the service bureaus that cater to the sign display market. Some service bureaus gang up their orders and print all of them together, since changing paper/film is costly and time consuming.

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CHAPTER IX: IMAGESETTER NEGATIVES

The first digital negatives were rendered with imagesetters. Imagesetters are used in the printing industry to produce film for exposing printing plates. Since many printing companies are shifting to direct computer–to–plate workflows, service bureaus with imagesetters are becoming more difficult to locate.

HOW IMAGESETTER NEGATIVES WORK

Imagesetters are unique in the way they reproduce tone. Unlike most other devices, they produce only two tones, clear film and solid black. The black is very dense, measuring in the neighborhood of log 4.0 transmission density or higher. Imagesetters achieve the appearance of continuous tone by spacing very tiny dots close together or further apart. This fools the eye, but in fact, a print made with an imagesetter negative only has two tones in it! One tone is paper white and the other tone is black dots of the alternative process. This does not mean that you cannot make a very fine print with an imagesetter negative. In fact, this characteristic makes it rather easy to make a print—almost foolproof. This feature makes imagesetter negatives excellent for use with alternative processes with short tonal scales. The screened printing gives the appearance of separation across a wider range of steps of density. This nature of imagesetter negatives, to render tone with dots, affects the density curve of the negative, giving it a slightly different shape than that of traditional, continuous tone negatives. The resolution of the screen used to render a negative can also affect the density curve as shown in Figure 9.1. This would suggest that shifting to a different resolution would require calibration of a new curve.

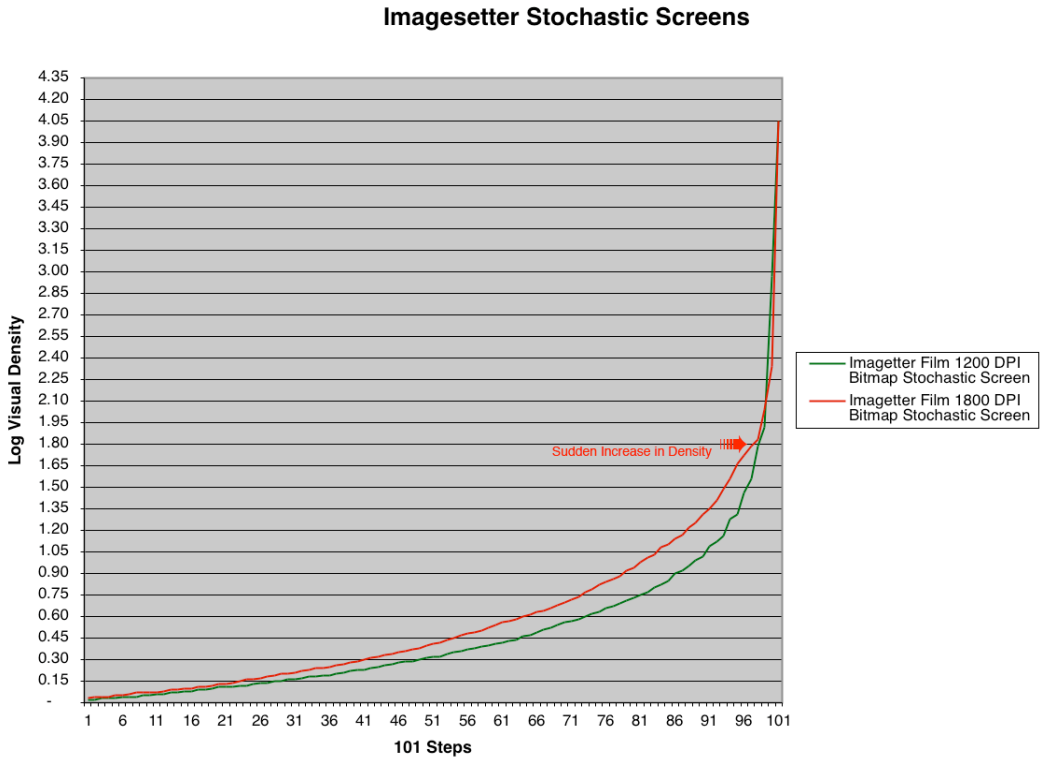

Figure 9.1 Density Curves of Imagesetter Stochastic Negatives With Bitmaps of Two Resolutions

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Imagesetters can render tone by two methods. One, the line screen, is an ordered series of variable sized and shaped dots. Most people do not use this screening method because it can appear too mechanical when viewed with a loupe, however it does provide smoother tones and less artifacts at certain critical tonal transitions. The alternative to the line screen is stochastic screening. This method uses a random pattern of tiny dots to render tone. This fine, random pattern of dots simulates film grain.

As mentioned above, imagesetters come in varying native resolutions. The higher resolution imagesetters are usually difficult to locate. It is important to find out what resolution the service bureau's imagesetter is capable of rendering, so that you can size your file accordingly.

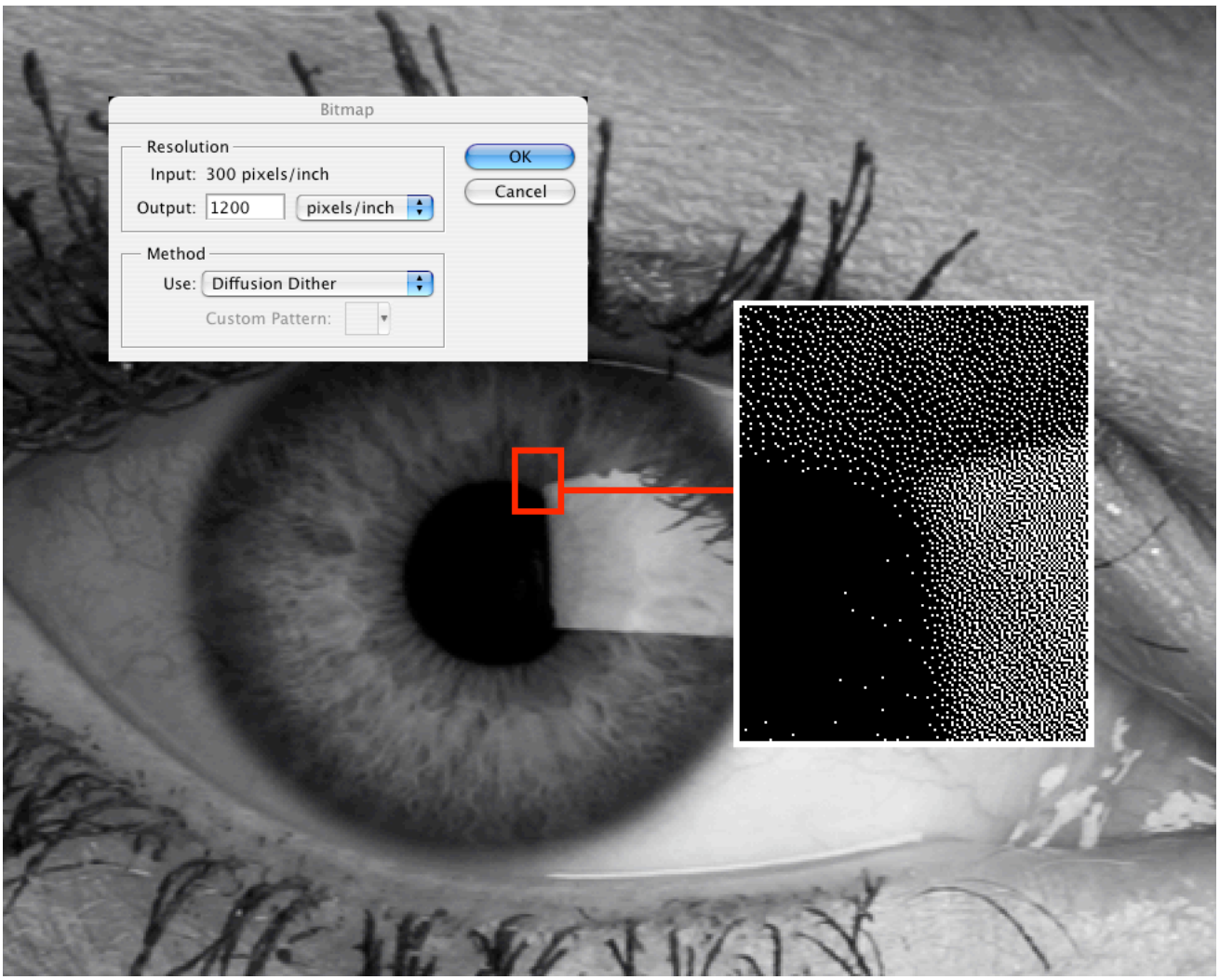

Figure 9.2 Conversion of Grayscale Image to Bitmap Image

For stochastic screening, two commonly used resolutions are a 1200 dpi bitmap or a finer 1800 dpi bitmap. Photoshop™ can be used to convert an 8-bit grayscale file to a bitmap file of one of these resolutions (*Image>Mode>Bitmap*), and enter 1200 or 1800 as the output resolution with Diffusion Dither selected as shown in Figure 9.2.

If you look at the image at 100%, you will easily see the stochastic screening effect—notice that the image is now made up of black and white dots, which is exactly what an imagesetter prints.

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Native Resolution

Imagesetters come in different native resolutions of 2400 dpi, 3600 dpi, and 4800+ dpi. Imagesetters require a 16 x 16 matrix of dots to represent the 256 possible tones in a pixel of an 8-bit file. Thus you can calculate the maximum number of pixels per inch the imagesetter can render and still give 256 tones by dividing the native resolution by 16—e.g. 3600 dpi/16 dots = 225 pixels per inch maximum file resolution to retain 256 tones. To determine how many tones can be rendered with a specific file resolution, divide the native resolution of the imagesetter by the file resolution and then square that number. For example, if the native resolution of the imagesetter is 3600 dpi and you wish to print a file that is 300 ppi, 3600 dpi/300 ppi = 12 dots and 12 x 12 = 144 tones. This relationship between resolution and tonality indicates that higher resolution negatives will have fewer tones remaining in the print. Sometimes this shows as posterization in areas of a print such as clouds, where there are very subtle tonal variations. This tonal loss is exacerbated further by the tonal loss that results from the Process Adjustment Curve that corrects the densities for printing.

It is important to discuss your requirements with the service bureau before you send them your file. It is often preferable to have the service bureau convert your file to a bitmap. They may have software for bitmap conversion that is more compatible with their imagesetter. The service bureau can suggest the optimum resolution for file submission. Remember, the greater the ratio between the input resolution output resolution in the bitmap, the greater the number of tones salvaged.

Substrate Choices For Imagesetters

There are no optional choices for substrates with imagesetter negatives. They are rendered on a film similar to Kodalith™, which is very high contrast with a DMax over log 4.0.

File Preparation for Imagesetter Negatives

File preparation for imagesetter negatives should follow previous recommendations with the following exceptions. The file should be sent to the service bureau as an 8-bit grayscale TIFF file. However, confirm this with the service bureau.

Service Bureau Standards For Calibration & Chemistry

Imagesetter Negatives, like the laser/LED negatives, will not be consistent unless the service bureau is careful to calibrate their machine regularly for alignment. The Sharpness Grid and the Smooth Gradient can be included in the file you send. Any problems of alignment will show up with these test palettes or in very smooth areas of the image file. Artifacts can also show up in various levels of the solid tones found in the Tonal Palette.

Imagesetter negatives are film negatives that require chemical development. If the developer is not kept fresh, the negatives can exhibit a variance in density. This will affect calibration and cause fluctuation in printing from one negative to another.

Ask the service bureau what their standards are for maintaining standards of their output. If you receive a negative that exhibits problems, contact them right away. They should supply you with a problem free negative at no charge.

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IMAGESETTER NEGATIVES AND OPTIMUM ALTERNATIVE PROCESS CONTRAST MIX

Since Imagesetter negatives simulate tone with the spacing of dots, it would seem that there would be little advantage in using one contrast mix over another. However, Figure 9.3 indicates that the exposure scale of the process does affect the resulting densities obtained with an imagesetter negative. As the chart shows, lower contrast mixes, or longer exposure scales, will require slightly less correction by the Process Adjustment Curve. Since the only means of correcting an imagesetter negative is the Process Adjustment Curve, the best combination to use is a long exposure scale and a finer or higher resolution screen (as indicated in Figure 9.1.)

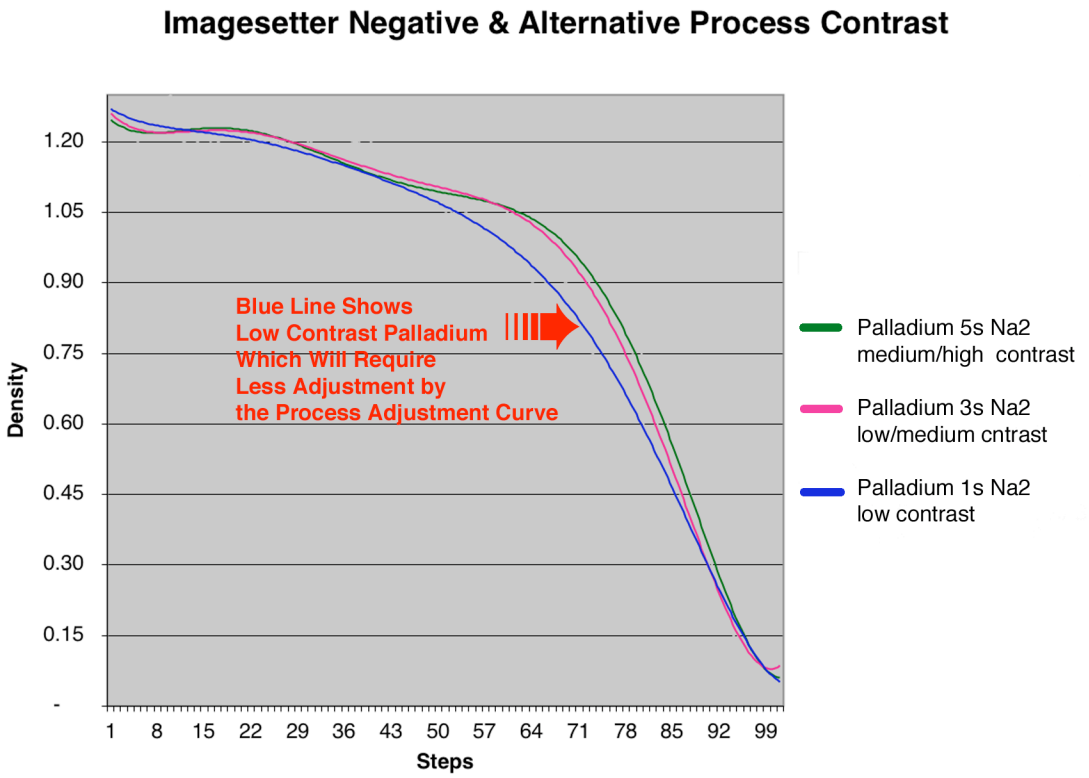

Figure 9.3 An Imagesetter Negative Printed With Three Contrast Mixes of Palladium

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CHAPTER X: OUTPUT DEVICES COMPARED

The chart below gives a comparison between digital output devices currently available at the time of the writing this book. The chart will probably be outdated before you finish reading it.

REFERENCE CHART COMPARING DIGITAL OUTPUT DEVICES

Comparison	Inkjet Negatives	Chromira™/Lambda™/ Lightjet™	Imagesetter
File Input Resolution PPI	360 PPI	300 PPI, 305 PPI, 405 PPI	300 PPI, 400 PPI, 450 PPI
Native Device Resolution DPI	2880+ DPI	300, 305, 405 DPI	2400, 3600, 4800+ DPI
Screen	Dithered Pattern	Pixels printed one for one	Line Screen or Stochastic Screen
Number of Tones Retained in Negative	256	256	256 or less, Depends on Imagesetter Resolution and Input Resolution
Capable of 16 Bit Rendering	No	No	No
Send 16 Bit File To Device	Yes, but will still only print 8 bit (256 Tones)	No, 8 bit only	No, 8 bit only
Preferred File Type	RGB best for negatives	RGB Only	Grayscale Only
File Format	Photoshop PSD, TIF	TIF (ask Service Bureau)	TIF (ask Service Bureau)
Color Capable	Yes	Yes	No
Media	Ink on Transparency Film	AgfaClear/FujiClear/DuraClear	Black & White High Contrast Film
Size	Depends on Printer & Film Sizes Available	4’ x 8’	24” x 30” and Larger
Approximate Cost for 8” x 10” Negative	$2.00	$18	$18
Durability	Low to Medium	High	High
Substrate Ultraviolet Light Density	Fairly Low Depends on Film Used Log .05-.15	High Log .70+	Low Log .05
Density Range of Negatives	Low to High	Medium	Very High
Source	Make at Home	Service Bureau	Service Bureau
Additional Costs	Purchase Printer	Burning CD or Transmitting File, Shipping CD, Shipping Negative	Burning CD or Transmitting File, Shipping CD, Shipping Negative
Turnaround Time	1-2 Hours Curing Time	48 Hours +	48 Hours +

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Part 4
Calibration

Healing Hands —m nelson © 2002

Searching is everything—going beyond what you know. And the test of the search is really in the things themselves, the things you seek to understand. What is important is not what *you* think about them, but how *they* enlarge you.
—Wynn Bullock

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CHAPTER XI: CALIBRATION—VARIABLES TO CONSIDER

This chapter covers a variety of issues that may have an effect on the process of calibration. These issues should be considered prior to launching your adventure into the calibration process.

HUMIDITY, DRYING TIME & POST EXPOSURE TIME

Earlier I mentioned that much of the research for this book was done using Platinum and Palladium printing. Since I was very interested in the long tonal scale that can be achieved with Palladium in particular, I used Dick Arentz's chart for the method of contrast control of Palladium using Na2 (Sodium Chloroplatinate). This chart is available on Dick's website at http://www.dickarentz.com/na2.htm.

It is no secret that relative humidity has a great affect on Platinum and Palladium printing, as it does on a number of other alternative processes. I am by no means suggesting that my method of dealing with this is the best, but I would recommend that taking into account some of the issues related to humidity might help you get more consistent results in your printing with many processes. Photographers live in a variety of climates and may have very different humidity issues to deal with—or none. Seasoned printers probably have built their own method of controlling humidity into their workflow. I live in Illinois, where the winter can bring extremely low indoor relative humidity, which adversely affects Pt/Pd printing.

I use a hygrometer to monitor the relative humidity in my workspace. I use a "cold air" humidifier to maintain a fixed level of humidity. This is a humidifier that uses a fan to blow room temperature air through a wick/filter to add humidity. Here is a summary of this part of my workflow for Palladium:

1. Boost the room humidity to 60% and hold it there
2. Place the paper to be coated about a foot above the exhaust of the humidifier and let it float there for about 20 minutes prior to coating the paper
3. Coat paper
4. Place coated paper in paper safe in an area of lower humidity for 20 minutes to dry
5. Expose Print Immediately
6. Develop immediately

This method gave me more consistent results, more even tones, and better DMax in my prints. I would caution that the times that I give are what worked in my home, with my workflow and my lucky underwear. I should also caution that for my situation this workflow is just on the edge of leaving an emulsion with enough moisture in it to stick to the negative. This does not make a pretty picture!

COATING THE PAPER

One problem contributing to inaccurate results in the measurements from the Tonal Palette is uneven coating. In the case of Platinum/Palladium printing, the most even coatings were done by photographers who coated with a rod or with the "Magic Brush". However, it is best to use the method you are accustomed to in your workflow—just try to coat as evenly as you can. The Curve Calculator spreadsheet is designed to help smooth minor variations.

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The amount of paper to coat in a coating session depends somewhat on the process. Some Alternative Photo Processes are more sensitive to time delays between coating and exposure. If this is the case, just coat what is needed for each step of the testing process. Remember to make sure that each palette is allowed sufficient drying time so that the densities have stabilized enough to evaluate.

Don't be too stingy with the size of the coated area for the Color Density Range Palette and the Tonal Palette. There is nothing worse than having coated the paper and finding that the palette negative extends beyond the edges of the coated area and cannot be used—allow an inch or so excess border of coated area to assure that the palettes can be placed in an area that is uniformly coated.

Consistent Exposure

Some Ultraviolet light sources may have hot spots that can cause uneven or erratic densities when printing the Palettes. This will give you erratic results. With fluorescent bulb systems that are not positioned properly, this might appear as bands of increased density in the print parallel to the tubes. With point source exposure systems, such as the NUARC, this might be due to irregular illumination of the UV light across the exposure field. If the problem is not too pronounced, the Curve Calculator will smooth out the reading variations caused by inconsistent exposure.

Durability of Negatives

When printing negatives, they are subjected to the most extreme conditions that artists take great efforts to avoid when protecting their artwork—intense ultraviolet light and heat. Since colored inks are used to create the inkjet negative and these inks are known to be sensitive to ultraviolet light, one might assume that there could be a color shift in the negative over time as it is used over and over. The same concern would apply to other negatives made with color films on high end imaging devices. This would definitely affect the printing characteristics of the negative, causing it to deviate from the "curve" it was created with. I am not aware of any studies that have been done which would indicate the extent of this damage—i.e. how many prints a negative can yield before there is deterioration in the negative densities.

Photo–Mechanical Processes and Calibration

There are a number of processes such as polymer photogravure and Gum printing that use what could be called a mechanical process as part of the development phase. This might take the form of spraying the developing print with water from a spray bottle or hosing it with a fire hose. This issue becomes important during the calibration process and subsequent print making since consistency is required for accurate calibration. I don't have a suggestion, such as what size orifice to use with the fire hose, but only suggest that you be as consistent as possible when using mechanical means to develop a print.

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How Much Coated Paper to Prepare for the Calibration Process

It does not require a lot of coated paper to calibrate an alternative process—if all goes well. If you are coating Carbon tissue, then you will probably want to do a batch large enough to both calibrate and make some prints. For other processes, such as Platinum and Palladium, I would suggest only coating enough paper at one time to provide what is needed for a particular step. My reasoning for this is based on the previous discussion regarding humidity and drying time.
The amount of coated paper required for the calibration steps are:

1. Determining the Standard Printing Time – 3" x 8" Strip (2–3 strips)
2. Determining the Standard Color Density – 4" x 8" Strip (1 strip)
3. Printing the Tonal Palette to determine the Process Adjustment Curve – 6" x 8" Strip (1 strip)
4. Printing the Final Tonal Palette – 6" x 8" Strip (1 strip)

The dimensions given also provide room to print a Standard 21-Step Test Tablet with each exposure. This is extremely important so you can judge consistency throughout the calibration process and trouble shoot any problems. The suggested number of strips is the minimum number required—if the dog eats one you will need more.

Alternative Processes With Contrast Control

In Chapter II, I briefly discussed this issue of working with different alternative processes that may or may not have a method of controlling contrast or the length of the tonal scale. For those alternative processes that do have a method of contrast control:

- Increasing the contrast of the chemistry will give a shorter tonal scale and less steps printed on a Standard 21-Step Tablet. The Standard Printing Time should increase.
- Decreasing the contrast of the chemistry will give a longer tonal scale and more steps printed on a Standard 21-Step Tablet. The Standard Printing Time should decrease.

If you will be working with an alternative process that has a method of contrast control, you should first determine the contrast mix you wish to use since the Standard Printing Time, Standard Color Density, and the Process Adjustment Curve are all dependant upon this variable. The mix you choose depends on your calibration goals.

You may have a favorite contrast mix or a batch of chemistry that is mixed for a specific contrast—if so, use it.

If you do not have a preference for contrast mix, I would suggest using a mix that is on the extreme end—with a low contrast and a long exposure scale. There are a couple of reasons for doing this when using inkjet or Color Density Range negatives is simple. The longer tonal scale will establish the limit of the color density required for the process. It may also indicate that the printer/ink set combination you are using is not capable of providing sufficient density for such a low contrast mix. It establishes a boundary. I prefer to know this first when working with a process and an output device.

The second reason for starting with a long exposure scale is that ink grain, or the dot pattern of the ink is rendered less noticeable by mixes of less contrast or lower grade papers.

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ALTERNATIVE PROCESSES WITHOUT CONTRAST CONTROL

If you are working with a process that does not have a method for contrast control or a mix of unknown contrast, then there is no choice but to dive right in and start the calibration process and follow it through as described. It will work just fine.

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CHAPTER XII: OVERVIEW OF THE CALIBRATION PROCESS

This chapter provides an introduction to the steps of the calibration process, which is covered in more detail in subsequent chapters. WARNING: You are about to experience a Paradigm Shift!

A DIFFERENT WAY OF THINKING WITH DIGITAL NEGATIVES

Printing with digital negatives is somewhat the reverse of printing with traditional in–camera negatives. With traditional negatives, the density range varies according to subject brightness range, exposure, film and the development used. Thus when printing traditional negatives you match the contrast mix and exposure time to fit the negative density range.

When using inkjet and other color capable digital negatives, the negative density range is matched to the Exposure Scale of the alternative process. Given a Standard Printing Time has been determined, this match is achieved by selecting an appropriate Standard Color Density for the negative and subsequently a Process Adjustment Curve that works best with this combination. The calibration process can be divided into three basic stages for a given alternative photographic process:

1. Finding the Standard Printing Time that will print at or near DMax with a given negative substrate (exposing through clear film, Base + Fog of the negative) – Use Standard 21-Step Test Tablet lapped over clear film substrate
2. Finding the Standard Color Density (Density Range of the negative) for your ink set and printer that will print paper white – Use Color Density Range Palette
3. Finding the Process Adjustment Curve that will adjust the printed relative tonal values to appear similar to the image you see on your monitor – Use Tonal Palette

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If you establish an accurate value for the Standard Printing Time (Step 1) and the Standard Color Density (Step 2) then Step 3 will give you a Process Adjustment Curve that is very precise. This will also produce a Process Adjustment Curve with gentler slopes that are less destructive to the tones in the image file, producing more tones in the final print. Figure 12.1 shows the relationship between Standard Printing Time and Color Density Range.

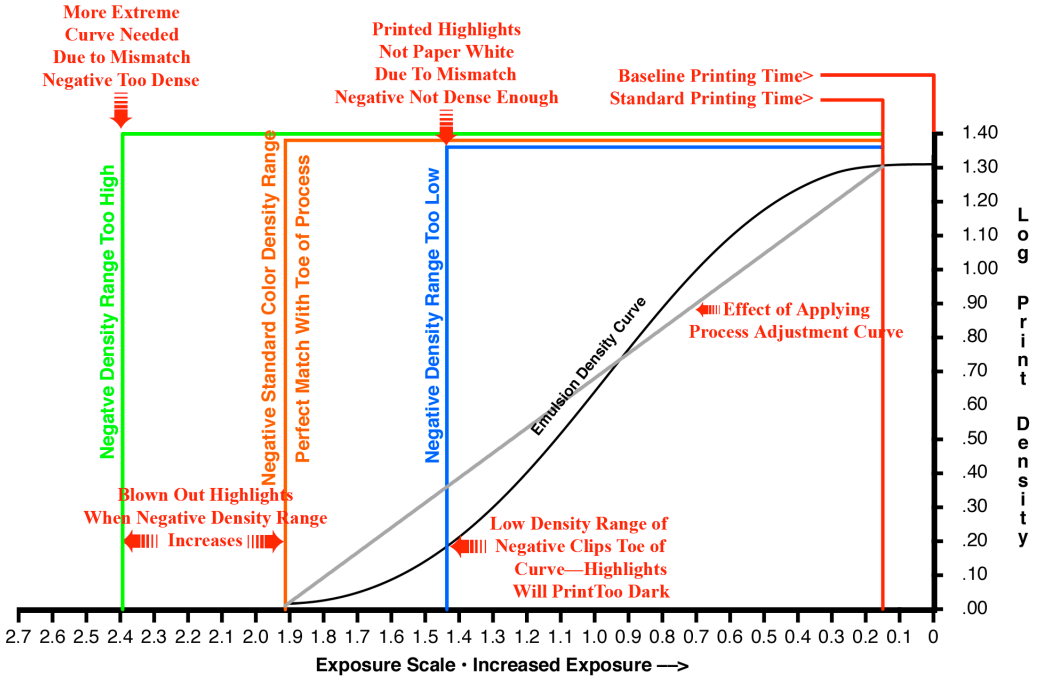

Figure 12.1 Matching Standard Exposure with Standard Color Density Results in a Better Process Adjustment Curve

As the above illustration shows, these steps determine the endpoints of the required negative density range. Once this is done, the Process Adjustment Curve does not have the additional burden of adjusting for any mismatch between the density range of the negative and the Exposure Scale of the alternative process.

When using imagesetter negatives, the contrast mixture (if possible) and exposure time is matched to the fixed density of the imagesetter negatives in order to achieve the best Process Adjustment Curve, one with the least amount of adjustment to achieve linearization of the image tones.

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THE CALIBRATION PROCESS STATED SIMPLY

At the risk of committing Déjà Vu all over again, here is a re-statement of the three primary steps of the Calibration Process for a given process, contrast mix and paper:

STEP #1: STANDARD PRINTING TIME DETERMINATION

*Determining the Standard Printing Time defines the point on the **Shoulder** of the process H&D curve that will be the **Darkest Tone** in the printed image.*

For a given contrast mix of a process, there is only one Standard Printing Time value. Deviation from this exposure value will change the Standard Color Density Value, which will not have a great affect on accuracy. However, deviation from this value will have a strong affect on the Process Adjustment Curve—and this is not a good thing—it produces a curve that is more drastic and destructive to image tones.

The digital negative has absolutely nothing to do with the determination of the Standard Printing Time. The Standard Printing Time is a product of the inherent density of the film or substrate that digital negative will be printed on and, of course, the process contrast mix. All that is needed to determine the Standard Printing Time is a Standard 21-Step Tablet, a strip of the film or substrate to be used, a UV light source and coated paper.

It may be tempting during the Calibration Process or later when printing images after the Calibration Process to tweak the tones of the image by increasing or decreasing the Standard Printing Time. This is sometimes tempting because the highlights may have a bit more tone than you wish or the darkest area of the print do not have *enough DMax*. Do not do this. This will defeat both the accuracy of the Standard Color Density AND the Process Adjustment Curve.

In The Platinum & Palladium Print, Dick Arentz presents a good discussion of Minor White's concept of *Convincing Black*. A monochromatic print does not have to have the absolute darkest tone possible with the process in order to appear a convincing black. The eye sees tones in relation to each other and will view a tone that is near black as being black. Certainly DMax freaks know that if you keep adding exposure, the black will get a little blacker. At some point, however, there is very little additional return on the investment of time and electricity. The method of determination of Standard Printing Time described later in this book should give a good, convincing black.

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STEP #2: STANDARD COLOR DENSITY DETERMINATION

*Determining the Standard Color Density defines the point on the **Toe** of the process H&D curve that will be the **Lightest Tone** in the printed image.*

Printing the Color Density Range Palette using the Standard Printing Time will define the color that has sufficient density to achieve Paper White or Near Paper White.

While some processes may have extremely long exposure scales with a Toe that seems to go on faintly forever, you then have to make a decision regarding where to cut off the toe. Obviously you do not want to cut off your toe to spite your curve, so it may be necessary under some circumstances with long exposure scales to accept a very tiny amount of tone as paper white—maybe in the neighborhood of Log .01 to .03. We might refer to this as *Convincing White*, though to some it might not be a *Minor* capitulation. (Sorry about that—I couldn't resist!)

STEP #3: PROCESS ADJUSTMENT CURVE DETERMINATION

*Determining the values for the Process Adjustment Curve defines the relationship between the printed tones in the image **between the end points on the Toe and Shoulder** of the H&D curve of the process. These end points and their determination were described in Steps 1 & 2 above.*

The Process Adjustment Curve accomplishes this feat by compensating for both the natural H&D curve of the process and the H&D curve of the ink set. This produces a print that matches the image as viewed on the monitor.

After reading these three primary goals of calibration, examine Figure 12.1 again and the relationship of these three goals will become clearer. Once you fully understand these three primary goals, you will accomplish the feat of cutting the shoulder and the toe wherever you wish and you will be handed the Keys to the Kingdom.

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THE CALIBRATION WORKFLOW

A summary of the workflow for calibration of an alternative photographic process is as follows:

1. Choose an Alternative Process
2. Choose a contrast mix (if applicable)
3. Determine a Baseline Printing Time for the clear film substrate
4. Determine a Standard Printing Time for the clear film substrate
5. For inkjet negatives, determine an appropriate Standard Color Density.
   (For imagesetter negatives skip #5 and go to #6)
6. For inkjet negatives, print the Tonal Palette on the film substrate.
   (For imagesetter negatives, send the file to the service bureau for printing)
7. Print the negative of the Tonal Palette with the alternative process
8. Determine the Process Adjustment Curve from the Tonal Palette
9. Apply the Process Adjustment Curve to the Tonal Palette file
10. For inkjet negatives, print a new negative of the Tonal Palette with the Process Adjustment Curve applied.
    (For imagesetter negatives, send the file to the service bureau)
11. Print the Tonal Palette with Process Adjustment Curve applied using the alternative process to verify the accuracy of the Process Adjustment Curve and provide you with a very helpful means of predicting tonal values in future prints

You may only need to do this process once. The resulting calibration values you determine can be used each time you print a new image—with the same results.

The Tonal Palette, described below, is a sophisticated digital step tablet created in Photoshop™ with 101 steps of tones of equal separation. The first printing of the Tonal Palette is used to determine the Process Adjustment Curve. The second printing, with the Process Adjustment Curve applied to the negative, verifies the Process Adjustment Curve and provides you with an alternative process Tonal Palette to refer to during the image file preparation phase and when adjusting image files to make subsequent prints—sort of like paint chips at the paint store.

If you have a darkroom and supplies for making gelatin silver prints, you might want to do a trial run with this method first using your favorite silver paper. In addition to the experience you will get, you will also end up with a method for using digital contact negatives with gelatin silver prints! This method produces great gelatin silver prints. Start with the lowest contrast grade paper possible.

The Calibration Process is a series of steps, each dependant upon the successful completion of all the prior steps. If you don't complete a step properly, the remaining steps will be invalidated. I find occasionally that an experienced printer may run into problems with the method more than a less experienced printer. Usually because the experienced printer will sometimes fudge a step based on past experience. When NASA launches a space shuttle, they don't fill the fuel tanks up to a mark that says *Close Enough*.

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CHAPTER XIII: CALIBRATION—STEP TABLETS & PALETTES

The Precision Digital Negative system uses three Palettes and step tablets for the calibration process. The following is a description of the features of these step tablets and how each one works.

THE STANDARD STEP TABLET

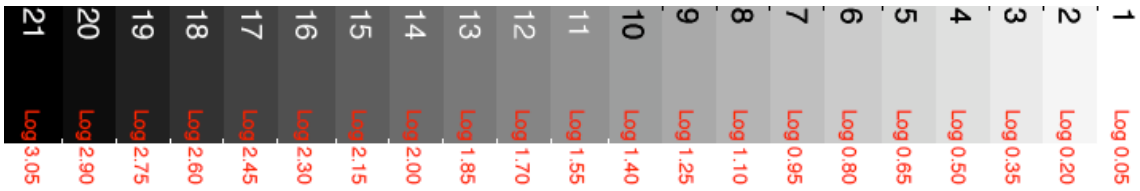

Figure 13.1 Representation of a Standard 21 Step Tablet

The Standard 21-Step Tablet is a transmission film step tablet that can be purchased from a variety of sources, including Kodak and Stouffer Industries (http://www.stouffer.net/). These step tablets have a series of graduated steps that differ by a specific log density, which can be converted into a specific amount of increase or decrease in printing time. When determining the Standard Printing Time with one of these step tablets, the goal is to expose the test tablet sufficiently until the two darkest printed steps merge, or print with the same reflection density. This merging of the two steps is necessary to be sure that the exposure time is long enough to assure that maximum or near maximum printed density has been achieved and additional exposure will not increase the printed density significantly.

Once this base exposure time has been determined, the Exposure Scale of the alternative process or sensitized paper is determined by the number of distinct steps showing tone. The Exposure Scale can then be expressed in terms of the number steps or log density of the step that achieves paper white (# steps times log .15) or the number of Stops (Log density of the step that achieves paper white/log .30)

The Stouffer® 21-Step tablet (T2115) is ideal for this. This step tablet has 21 steps, each step increasing by log .15 density or 1/2 a stop, as shown in Figure 13.1. Many readers may already have one and know how to use it. The T2115 is small—1/2" x 5", so it does not require much coated paper to print it.

While the 21 step tablet is the most commonly used step tablet, I prefer the Stouffer® T3110, a 31-step tablet with log .10 or 1/3 stop steps. The dimension of this step tablet is 3/4" x 8". The extra width of this step tablet makes the method described below of "lapping" a strip of the substrate easier to do and the results easier to read.

As you will see, the Standard 21-Step Tablet is required during the Calibration Process to determine the Standard Printing Time. Subsequently the Standard Step Tablet, when used with any printing, will provide valuable feedback regarding the consistency of your printing and help with troubleshooting causes of printing failures.

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THE COLOR DENSITY RANGE PALETTE

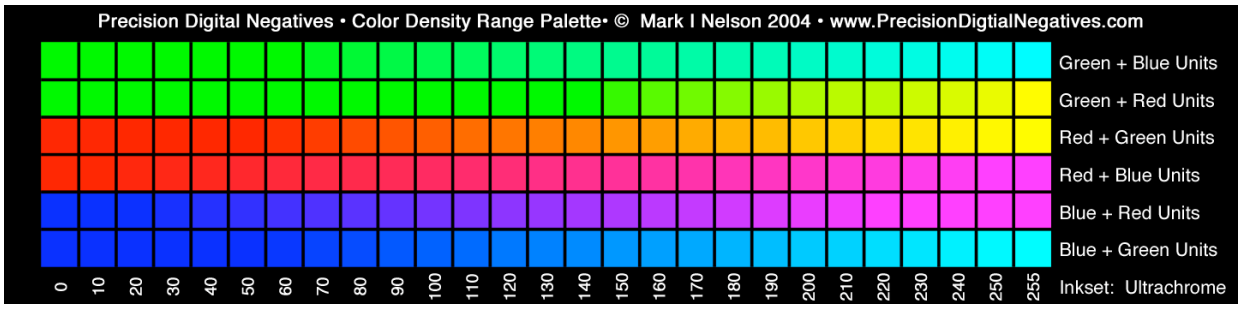
Precision Digital Negatives • Color Density Range Palette• © Mark I Nelson 2004 • www.PrecisionDigtialNegatives.com
Green + Blue Units
Green + Red Units
Red + Green Units
Red + Blue Units
Blue + Red Units
Blue + Green Units
Inkset: Ultrachrome
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 255

Figure 13.2 Color Density Range Palette

The Color Density Range Palette, similar to the image in Figure 13.2, is designed to determine the Standard Color Density for a given alternative process printed with the Standard Printing Time. The Standard Color Density is the color or hue that provides just enough density to print paper white with a given alternative process (and contrast mix if applicable) when printed at the Standard Printing Time. This color is then used to convert the tones (0-255) of a black and white negative into 256 saturation levels of the same color. Thus the density range of the negative becomes an exact match for the Exposure Scale of the alternative process being calibrated.

The Color Density Range Palette is included with the Precision Digital Negative system as a file that is printed on the chosen film substrate. The colors are carefully chosen to eliminate any use of black ink. These colors are also chosen such that they are capable of rendering all 256 levels of tone.

The variation of the colored steps of the Color Density Range Palette is designed to span a broad range of colors or hues that will print without using black ink. The color variation is based on the three primary colors of the RGB system, Red, Green and Blue. Each of these colors is printed with a mix of only two inks:

- Red = Magenta ink + Yellow ink
- Green = Cyan ink + Yellow ink
- Blue = Cyan ink + Magenta ink

In the Photoshop™ Color Picker, these three colors are represented by the following values:

Red: R=255, G=0, B=0
Green: R=0, G=255, B=0
Blue: R=0, G=0, B=255

There are millions of possible colors that could be used for Color Density Range Control[patent pending]. There are also a variety of Color Modes or Models that can be used to represent them. This system uses the RGB color model or mode for a number of reasons. For this purpose it is more precise, less confusing, and avoids the introduction of black ink into the mix.

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Standard inkjet printer drivers convert other modes to RGB mode then to CMYK mode in the process of printing. Sending a file in any other mode but RGB will cause this double conversion to take place. Within the RGB Mode, not all the colors make effective filters. In some cases this is because they are produced with black ink when printed and, as mentioned before, black ink causes a variety of problems in negatives.

In other cases, some colors do not work well when converting a gray scale negative. There are some limits in the mathematical representation of the color model that causes a reduction of possible tones when this conversion takes place. Remember the goal is to preserve all 256 possible tones in a negative. Certain colors will not do this. When converting gray scale tones to a hue or color with levels of color saturation equivalent to the number of gray scale tones, these colors will exhibit a number of anomalies on the tonal scale where adjacent steps are the same saturation level and will not print with tonal differentiation. In one case I tested a popular color used for inkjet negatives and the color caused a loss of 51 tonal steps of the 256 possible steps. This problem becomes even more extreme with additional tones lost due to the curve that would be used with this color. Since this color does not match the Color Density Range requirements of the process it was designated for, and the adjustment curve has to make up for this mismatch, an additional 30 tonal steps might be lost. The final negative would then only contain about two thirds of the original tones in the image file!

The choice of colors for Color Density Range Control[patent pending] is thus limited to a narrow range of colors that are a variation of Red, Green and Blue. Each of these three colors has 512 combinations, which gives a set of 1,536 possible color combinations. Given that most ink sets will usually produce up to 3 colors within this set that print with the same density, this reduces the potential number of densities to the neighborhood of 500. Depending on the ink set's potential overall Color Density Range Potential, which may include the range from a low of log .40 to as high as log 3.6, you have a range of log 3.2 (3.6–.4). If you divide 3.2 by 500, you get a log value of .0064, which would be the theoretical difference in log density between two adjacent colors—which is both beyond my eye to detect and beyond the capability of my trusty reflection densitometer to detect. Thus I think it is safe to say that a Standard Color Density can be determined with great precision—probably more precision than that of my trusty eyedropper when mixing of chemicals.

Changing the ratio of the two component inks of Red, Green, or Blue varies the color and UV density. The ratio of the two inks is modified by reducing one or the other of the two component inks until only one ink remains. For example, to get the range of densities for Red, you decrease the amount of yellow ink until only magenta ink remains, or, you decrease the amount of yellow ink until only magenta ink remains. Thus, each of the three primary colors has two Color Branches giving any ink set a total of 6 Color Branches. I refer to the shape of the plots of the UV density of these 6 branches as the (UV) Color Density Signature of the ink set.

For all the ink sets that I have tested, the densities of the pure inks (C, M, or Y) all fall in this order:

1. Highest Density – Yellow
2. Middle Density – Cyan
3. Lowest Density – Magenta

This relationship between the densities of the three inks also holds true when you examine the two branches of colors derived from Red, Green and Blue. The higher branch will always be the branch that goes to the ink that ranks higher in the list above. For example, for Green, the branch towards pure Yellow will have higher densities than the branch towards pure Cyan.

What is most interesting is that the order of density of the primary colors (Red, Green and Blue) varies between ink sets.

I do not make specific recommendations regarding Standard Color Densities to be used in printing the Tonal Palette or in fabricating negatives for different alternative processes or contrast mixes for specific alternative processes. Since there are so many ink sets, printers, and even variance among the same model of printers, it is extremely important for you to make the determination of the Standard Color Density for your printer and ink set with the Color Density Range Palette.

THE TONAL PALETTE

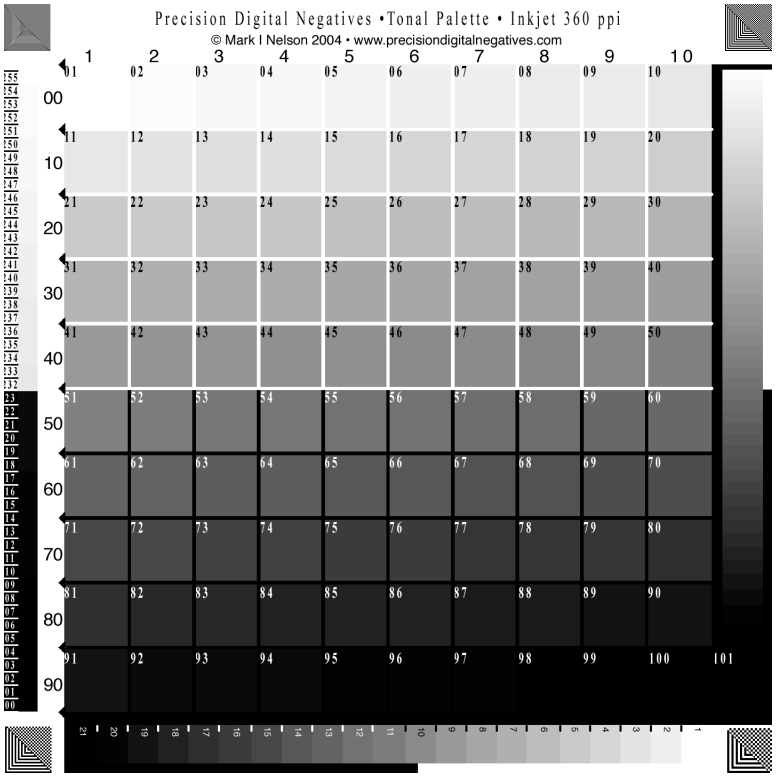

Figure 13.3 Tonal Palette Without a Standard Color Density Applied

The Tonal Palette, as shown in Figure 13.3, is a complex step tablet that is printed with the alternative process using the Standard Printing Time with the Standard Color Density. The 101 tonal steps, once printed with the alternative process, are measured to determine the Process Adjustment Curve using the Curve Calculator. Once the Process Adjustment Curve is determined, the Tonal Palette is reprinted with this curve applied to verify the accuracy of the curve. If the curve appears accurate, this second Tonal Palette is then used as a guide to future image adjustment and printing. You can see the exact printed tone that a specific area of an image file will print by sampling that area with the Eyedropper Tool and matching that value with the corresponding value on the Tonal Palette.

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The Tonal Palette also includes a digital 21-step tablet along the bottom. Once this step tablet is printed with the adjustment curve applied, you should see an even distribution of tone between the steps and each printed step should be visible. Unlike the Standard 21-Step Tablet, this digital 21-step tablet will print with tone in all the steps except step #21.

There is also a smooth gradient on the right side of the Tonal Palette that will provide another visual guide of the printed tonal relationships. This gradient is also helpful in identifying banding or any artifacts that might occur at certain tonal ranges due to printer settings or printer malfunctions.

There are 4 grids of vertical and horizontal lines next to a checkerboard. These grids are made up of 1, 2, 3 and 4 pixels. Figure 13.4 shows an example of one of these grids. The grids provide an indication of the accuracy of the alignment of the output device and the ability of the device to render detail. Once printed with the alternative process, the grids will also indicate the capabilities of the alternative process and paper used to render the detail of the negative. The checkerboard portion of the 1 Pixel Grid is usually very difficult for a device to render properly. This often is due to the dithering pattern of the software.

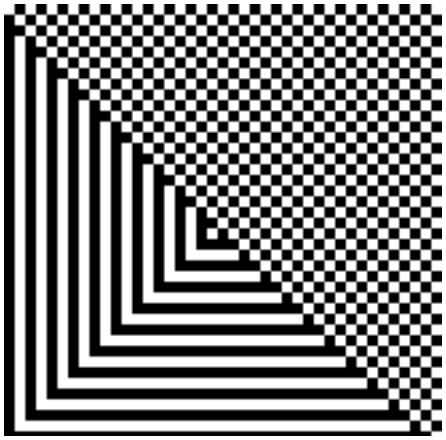

Figure 13.4 One Pixel Grid

Along the left side of the Tonal Palette are two small step tablets that are exactly one tone apart (0-255). They represent both the highest range and lowest range of the digital tonal scale. They are helpful to determine exactly where the DMin and DMax occur.

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CHAPTER XIV: CALIBRATION—THE STANDARD PRINTING TIME

Determining Standard Printing Time – 3" x 8" Strip (2–3 strips)

Determining the Standard Printing Time is the first of the three steps for the calibration of printing with digital negatives and a specific alternative photographic process. Basically, during this step, you are finding the minimum exposure time that will give at or near maximum density in prints—using the film substrate and alternative process you have chosen.

Here, I will remind you again of the importance of keeping variables constant. Pick the paper you wish to use, the contrast mixture you plan to use (if applicable), keep the temperatures constant, keep the humidity constant, keep the coating method constant, keep the exposure source constant, keep the development method constant, keep the dry down time constant, wear the same under shorts, etc., etc., etc.—and write all these variables down!

The UV source used for exposure must be reliable. It is very important to be able to repeat the Standard Printing Time consistently. Most of the photographers who tested this system used a NUARC plate burner or similar exposure devices. In some cases, a bank of fluorescent tubes was used with a built–in integrator to assure consistent exposures.

DETERMINING THE BASELINE PRINTING TIME

When you use a Standard 21-Step Tablet to determine your Baseline Printing Time, you are first exposing long enough so that the two darker printed steps merge, the Baseline Printing Time. By merging, I mean that the two darkest printed steps (steps #1 & #2) look relatively equal in density. By lengthening the printing time until two steps merge, you have confirmed that the amount of exposure has reached a point where additional exposure is not going to give any significant additional print density. This is a Baseline Printing Time from which you determine the Standard Printing Time.

If you see obvious separation between all the printed steps, including steps #1 and #2, then you have underexposed and should at least double the Baseline Printing Time in the next attempt.

If you see that more than two steps, say steps #1, #2, and #3 have merged, then you have overexposed by at least 1/2 stop (with the 21-step tablet), so you would multiply the exposure time/units by .71 to get an exposure that should show just steps #1 and #2 merging. If you see 4 steps merging, then you would cut the exposure time in half, since two steps equal a full stop.

I make one modification to this method, as shown in Figure 14.1 for inkjet or laser/LED negatives.

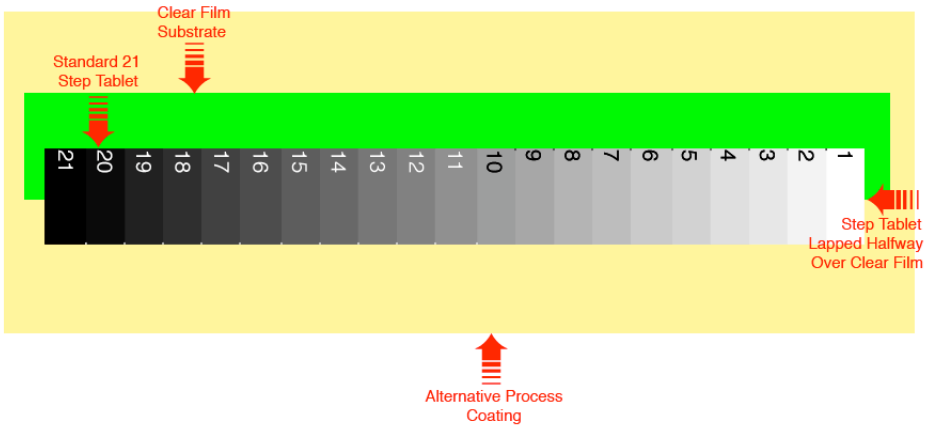

Figure 14.1 Layout Showing Standard 21-Step Tablet Lapped Over Edge of Substrate

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Sam Wang taught me this trick. The substrate or film that inkjet negatives are printed on may have a higher UV density than the film of standard film negatives, or a have a higher base plus fog. This can be factored into the Baseline Printing Time by taking a clear strip of substrate and lapping the Standard 21-Step Test Tablet over it when printing.

The printed steps of the Standard 21-Step Tablet that lap over the clear substrate will show two steps merging up to half a stop (one step) lower than the printed steps not lapped over the film as shown in Figure 14.2.

Clear Film Substrate
Alternative Process Coating
Standard 21 Step Tablet
Two Steps Merged
21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Lapped Substrate & Step Tablet
Three Steps Merged

Figure 14.2 Printed Step Tablet Showing 2 Merged Steps Through Film and 3 Merged Steps With No Film

Thus you can adjust your Baseline Printing Time accordingly for the negative substrate you are using. If you change to a different brand of substrate having a different UV density, then you should recalibrate the Standard Printing Time.

This lapping is not necessary to do when the negative will be rendered with an imagesetter, since the base plus fog of the imagesetter negative (about log .05) is usually the same as that of the Standard 21-Step Test Tablet. This base plus fog of the imagesetter film can be confirmed by checking with the service bureau that will be printing the negative.

Determining the Standard Printing Time

Next, adjust this Baseline Printing Time to determine the Standard Printing Time. The Standard Printing Time is determined by multiplying the Baseline Printing Time by .71, which reduces the exposure by 1/2 stop or one step on the Standard 21-Step Tablet (one of the merged steps). Without this adjustment, the shadows of a print would block up and it would require a stronger Process Adjustment Curve to remove the blocking in the shadows.

Determining the Standard Printing Time is an extremely important step in the whole process and can have a great influence on the curve you end up creating. If you do it properly, it will save you a lot of time and frustration. It is good practice to print a final version of the Standard 21-Step Tablet using the final Standard Printing Time for comparison with those from the next calibration steps.

For your convenience, the Curve Calculator spreadsheet includes an Exposure Calculator (Tab-F), that determines the adjusted exposure time for both the 21 and 31-step tablets. Just enter the exposure time used and look for the number of steps on the tablet you wish to reduce the exposure time by. New exposure times are calculated both for a 21-step tablet with 1/2 stop steps and for a 31-step tablet with 1/3 stop steps.

If you are a highly experienced printer and are tempted to skip this method of determining the Standard Printing Time because you feel you already have a *good printing time*, resist the temptation!

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CHAPTER XV: CALIBRATION—DETERMINING THE NEGATIVE DENSITY RANGE

Determining Standard Color Density – 4" x 8" Strip (1 strips)

Once you have determined the Standard Printing Time, if you are using a color output device for negatives, you can now determine the Color Density Range you need for your negative. The next step uses the same contrast mix and Standard Printing Time determined previously. Using these same values will determine the Standard Color Density required for later printing the Tonal Palette and subsequently your negatives.

PRINTING THE COLOR DENSITY RANGE PALETTE

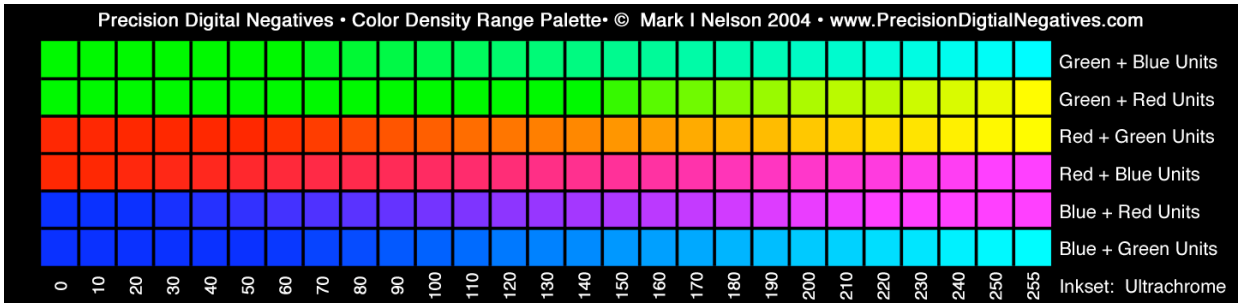
Precision Digital Negatives • Color Density Range Palette• © Mark I Nelson 2004 • www.PrecisionDigtialNegatives.com
Green + Blue Units
Green + Red Units
Red + Green Units
Red + Blue Units
Blue + Red Units
Blue + Green Units
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 255
Inkset: Ultrachrome

Figure 15.1 Color Density Range Palette

The following steps outline the printing of the Color Density Range Palette:

1. Open the image file of the Color Density Range Palette called *ColorDRPaletteInkjet.psd*
2. Print the Color Density Range Palette on the film substrate using the Printer Setup described earlier
3. Allow at least 2 hours drying or curing time for inkjet Color Density Range Palettes
4. Place the Color Density Range Palette on the coated paper so that you can also place a Standard 21-Step Tablet next to it and lapped over the edge of clear film.
5. Expose the Color Density Range Palette with your alternative process using the Standard Printing Time
6. Develop, Fix, Wash, etc.
7. Allow sufficient dry down time for the printed tones to stabilize

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DETERMINATION OF THE STANDARD COLOR DENSITY

Once the Color Density Range Palette has been printed with the alternative process using the Standard Printing Time and allowed to dry sufficiently, the Standard Color Density for this combination can be determined. The Standard Color Density is determined by locating the steps of the Color Density Range Palette that just print at or near paper white as shown in Figure 15.2.

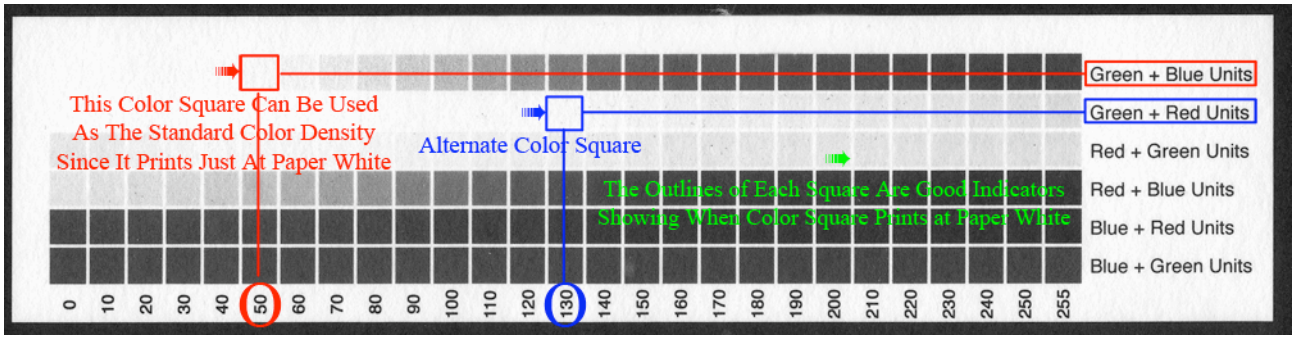

Figure 15.2 Printed Color Density Range Palette

The printed Color Density Range Palette will show one or two ranges of steps that print paper white. By locating the cluster of steps that print paper white, you can track in either direction until you locate steps that are just beginning to show density. To help locate these steps, the original negative has a black border, which is more dense than the steps and should print paper white. Visually you can see where the printed white border "disappears" against the steps, indicating that the step is paper white. It will not be unusual to find two to four such steps on the Color Density Range Palette.

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The reason for this can be explained by looking at Figure 15.3, a chart of the UV densities of an ink set.

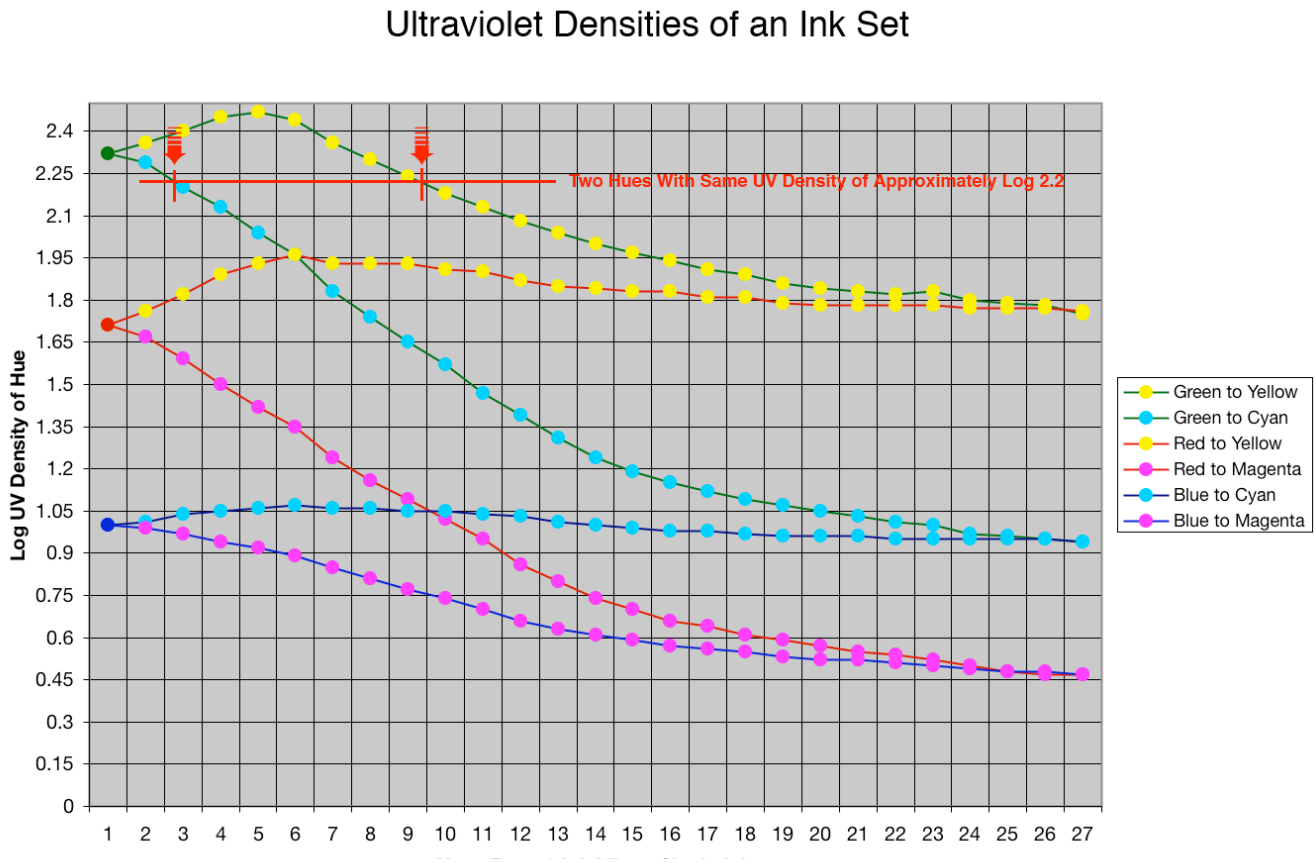

Figure 15.3 Two Color Squares From Color Density Range Palette Having Same Color Density

Notice that in the above illustration there are a number of levels of density that can be traced to the right of the graph and the line will intersect with more than one Color Branch of the ink set. There are even cases where such a horizontal line will intersect the same Color Branch twice.

PICKING THE BEST STANDARD COLOR DENSITY

Since there may be four possible Standard Color Densities that could be used, the question arises as to whether there is any advantage to picking one over the others. I make my choice based on the signature of the ink set I am using. The printed Color Density Range Palette also provides the clues. This example is not meant in any way to indicate the BEST color or color branch to use when making negatives. Remember, Color Density Signatures vary a great deal from one ink set to another.

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Density Curves of the Candidate Standard Color Densities

First there is an assumption (which you may test if you wish) that I make regarding the relative effectiveness of various colors and their densities. I have not tested this assumption, but may do so in the future. The assumption is as follows:

There is no difference in the effectiveness of different color inks having the same Color Density when printing with a particular alternative process—they will both print with identical density curves with the alternative process.

This assumption is based on the fact that when different color inks of the same color density are used to fabricate a digital step tablet and then measured with a UV transmission densitometer, the density curves are identical. So I have extrapolated, wisely or unwisely, to the above assumption from this fact. However, it is possible that there may be an alternative process that *prefers* one color to another.

Ink Mix

If you examine Figure 15.3 showing a graph of the UV density signature for an ink set, you notice that the horizontal line passes through two colors of identical density. These two points occur on two different Branches of the ink set. My choice on the basis of ink mix would be points that are to the left side of the chart. This is because the ratio of the two inks that comprise the colors approaches 1:1 as you move left. This provides an increased amount of overlap of the ink dots of the two colors and thus less distinct ink dots when printing with the alternative process. The print is smoother. Based on this assumption, the choice should be the intersection point on the far left.

Density Trend Line of the Color Branch

The two intersection points in Figure 15.3 are on two different branches of the ink density signature. Notice the shapes of the plots of these two branches. One is relatively flat and the other has a steeper gradient and spans a much wider range of density. I prefer the Green to Cyan branch also because it will allow more variance in density when moving from Green to Cyan. The adjustment of color #1 between Red and Yellow does not give a good positive variance in density.

While I have referred to a chart of UV densities of this particular ink set for deciding which Standard Color Density to choose, similar information can be determined by examining the printed Color Density Range Palette as shown in Figure 15.2. The printed Color Density Range Palette will indicate those colors that have just enough color density to achieve paper white with the alternative process you are calibrating. In this illustration there are two lines of color squares that have squares that print at paper white. The line indicated with the blue square shows very little change color density from one color step to the next. The second line shows a larger variation in steps and indicates a Color Branch that will give more latitude when used with variations in the contrast mix of the alternative process. The best choice for the Standard Color Density would therefore be the color square outlined in red.

Noise in Ink Grain at Certain Levels

The dither pattern of ink will have more noise at certain values (0-255) than others. For example, with the Epson 2200, the Color Density Range Palette exhibits a lot of noise or noticeable dots at value 100. When picking the Standard Density Color, examine the Color Density Palette printed on the film with a loupe and be sure to avoid picking a noisy Standard Color Density—this will show up in the highlights of the print. If that seems to be the only choice, an adjustment in contrast mix slightly higher or lower will solve the problem.

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COLOR CHOICE AND NOISE

With some processes one of the choices may show more apparent ink grain at a variety of levels than another. I suspect this has to do with the difference in density between the two component inks. Yellow tends to have the highest UV density, with Magenta having the lowest and Cyan falling in between. Thus the two Red Ink Set Branches, being made up of Yellow ink and Magenta ink, may exhibit more grain pattern than the two Green Ink Set Branches, which are made up of Yellow and Cyan inks. This is because the difference between the UV densities of Yellow and Magenta comprising Red is greater than the difference between the UV densities of Yellow and Cyan comprising Green. This comparison is shown in Figure 15.4. If this is a problem, try the Standard Color Density indicated on the Green Ink Set Branches, if there is one.

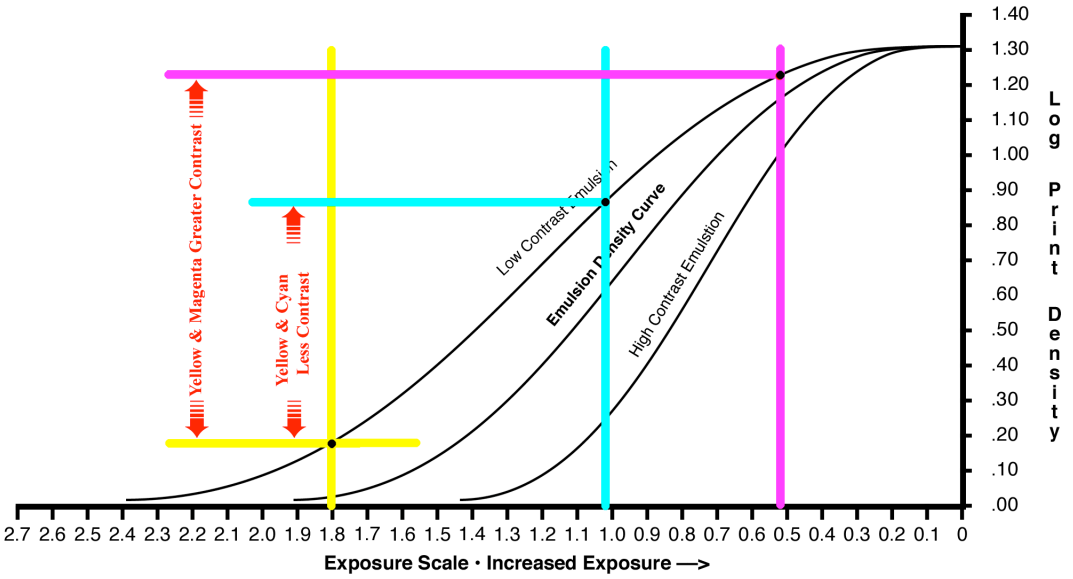

Figure 15.4 Ink Grain Noise and Contrast of Cyan, Magenta and Yellow Inks

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DETERMINING THE RGB VALUES OF THE STANDARD COLOR DENSITY

The Color Density Range Palette has a scale along the bottom edge that varies from 0 through 255. This scale indicates RGB values used to determine the color of the steps in the column directly above the number. The six rows of steps are the color branches of the ink set. In the example in Figure 15.2 the value *50* has been circled in Red.

Since this Branch of colors is a variation of Green to Cyan, the RGB values for this Standard Color Density would be Red=0, Green=255, and Blue=50. Figure 15.5 shows these values being entered into the Color Picker.

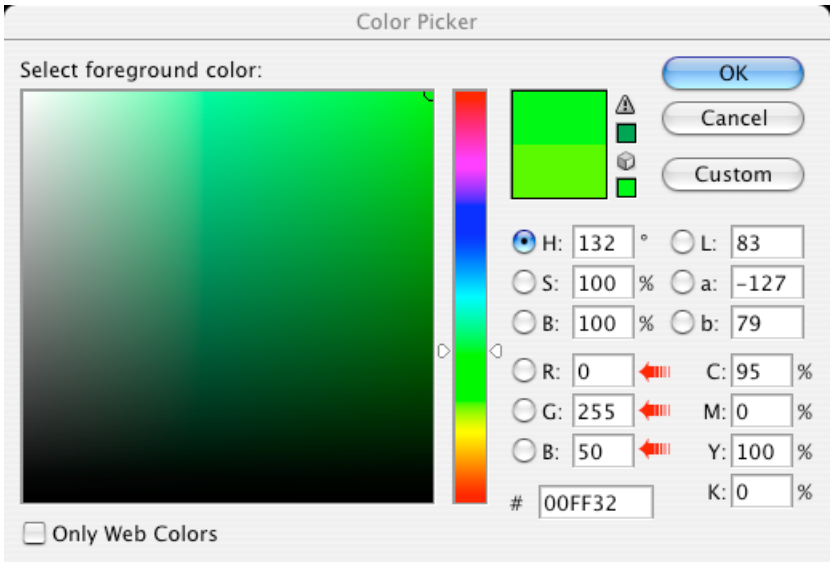

Figure 15.5 Entering Standard Color Density Values Into the Color Picker

The Color Picker is accessed by clicking on the Foreground Color in the Tool Palette. If the alternate Standard Color Density on the Green to Yellow branch were chosen, the values would be Red=130, Green=255, and Blue=0.

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COMBINING THE STANDARD PRINTING TIME & STANDARD COLOR DENSITY STEPS

The determination of the Standard Printing time and Standard Color Density were presented conceptually as two distinct steps. They can be partially combined to save at least one printing of the alternative process during calibration. After determining the Baseline Printing Time and computing the Standard Printing Time, print the Standard 21-Step Tablet lapped over the substrate along with the Color Density Range Palette. Figure 15.6 shows the layout to combine these two steps.

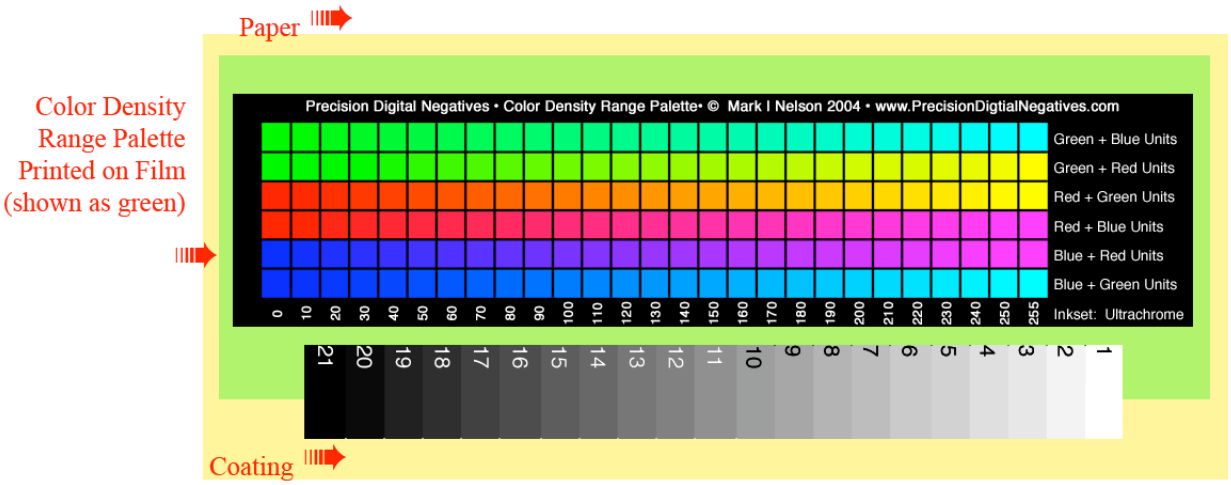
Paper
Color Density Range Palette Printed on Film (shown as green)
Precision Digital Negatives • Color Density Range Palette • © Mark I Nelson 2004 • www.PrecisionDigtialNegatives.com
Green + Blue Units
Green + Red Units
Red + Green Units
Red + Blue Units
Blue + Red Units
Blue + Green Units
Inkset: Ultrachrome
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 255
21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Coating

Figure 15.6 Layout For Printing Color Density Range Palette Combined With Final Standard Printing Time

When combining the two steps like this, all you are concerned with is getting an accurate exposure with the Standard Printing Time. If the print of the Standard 21-Step Tablet indicates this is true, then the printing of the Color Density Range Palette is accurate and it can be used to determine the Standard Color Density.

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At this point in the Calibration Process, the Standard Printing Time and the Standard Color Density have been determined. Figure 15.7 shows the relationship between these variables.

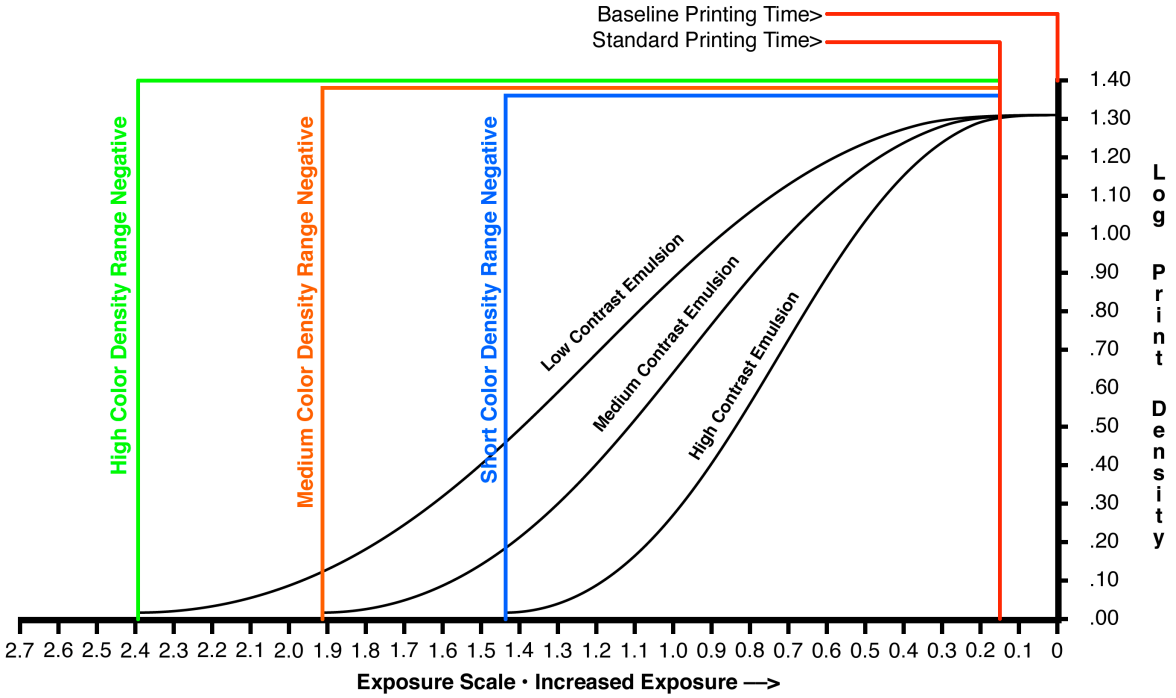

Figure 15.7 Relationship Between Standard Printing Time and Color Density Range for Three Process Contrast Mixes

IMAGESETTER NEGATIVES

If you are using imagesetter negatives, which are not capable of rendering color, the use of a Standard Color Density does not apply. As previously mentioned, imagesetter negatives are of a fixed density and the Process Adjustment Curve must also be used to match the density of the negative to the Exposure Scale of the alternative process as shown in the next chapter. Imagesetter negatives only require two steps in the calibration process, determination of the Standard Printing Time and determination of the Process Adjustment Curve.

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CHAPTER XVI: CALIBRATION—DETERMINING THE CUSTOM PROCESS ADJUSTMENT CURVE FOR A LINEARIZED PRINT

The Process Adjustment Curve is an adjustment curve that is applied to a digital image file after all other image adjustments are complete. The purpose of this curve is to adjust the negative's relative tonal density such that the image will print properly with the alternative process. This adjustment of the negative's densities causes the printed tonal values to be linearized, so they appear the same as the image displayed on the calibrated monitor.

The Process Adjustment Curve for a linearized print does three things:

1. Adjusts for the curve of the ink densities
2. Adjusts for the curve of the process
3. Adjusts for your unique workflow

When using imagesetter negatives, the Process Adjustment Curve has one more function: to adjust the negative density range to match the density range requirements of the alternative process. With output devices that are color–capable, this is not necessary, since the Standard Color Density determined in the previous calibration step makes this adjustment.

There are various imagesetter and inkjet "curves" floating around in Cyberspace, however, these "Cookie Cutter Curves," as Dick Arentz calls them, are usually more frustrating than helpful. I often hear someone say "I tried so–and–so's curve and it worked great!" Well, sure it did, sort of. All Process Adjustment Curves have roughly the same shape. The curve is a reverse "S" shaped curve that opens up the shadows and adds texture to the highlights of the print. It is easy to prove that such generic versions of a curve will only work best by chance. What paper and contrast mix was the curve based on? What humidity level? What workflow? What alternative process? Determine your own custom curve for your workflow and avoid wasting fine paper, expensive chemicals, and your time.

There are some workflows that apply this curve to the image file in its positive state. I prefer to develop the curve and apply it to the image file in the negative state. Either method will work and result in the same print. However, I find it much easier to think of how I want to change the negative's tonal densities to affect the print densities. This also keeps separate the two distinct workflow segments of image file preparation and negative preparation.

This system uses the Tonal Palette to determine the Process Adjustment Curve.

PRINTING THE TONAL PALETTE WITH COLOR CAPABLE DEVICES

Printing the Tonal Palette to Determine the Process Adjustment Curve – 6" x 8" Strip (1 strip)

With this workflow, the Tonal Palette is not inverted to the negative state prior to printing on the film substrate as will be done with image files. There is no need to, since you would just end up with the same tones in reverse order and an extra step in the workflow to reverse all the values in calculations.

Open the TonalPaletteInkjet.psd file on the CD with Photoshop™. You will notice that the file has a lot of white space at the bottom. This is so the Tonal Palette image is forced to the top of the sheet of film rather than in the middle, thus wasting transparency film. This file, designed for inkjet printers only, is an RGB file designed to print exactly as it is using the Printer Settings described in the section Printer Settings for Inkjet Negatives.

When you open the file, the Tonal Palette will appear on your monitor as in Figure 16.1.

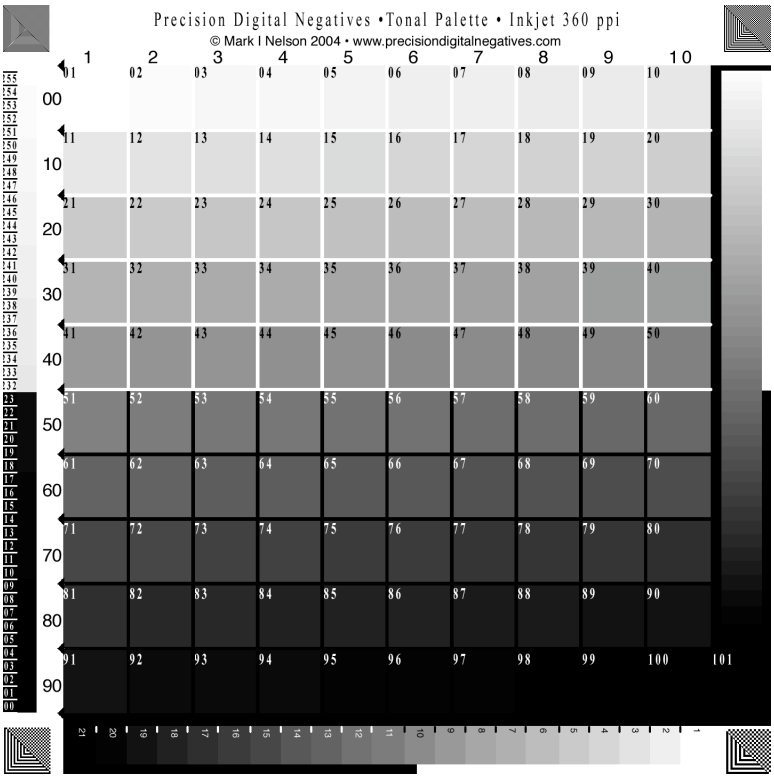

Figure 16.1 The Tonal Palette When First Opened

The next step is applying the Standard Color Density to the file. Open the Layers Palette and find the layer called "Standard Color Density" as shown in Figure 16.2.

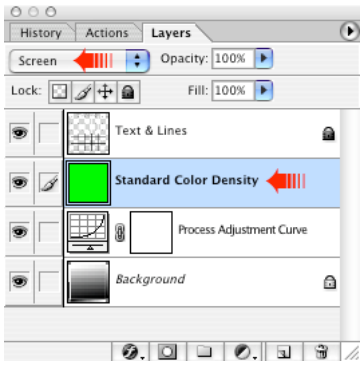

Figure 16.2 Filling the Standard Color Density Layer

Click on this Layer to make it active.

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Click on the Foreground Color in the Tool Palette to bring up the Color Picker. Enter the RGB values for the Standard Color Density you determined from the Color Density Range Palette as shown in Figure 16.3. Here the values R=0, G=255, B=50 are being entered.

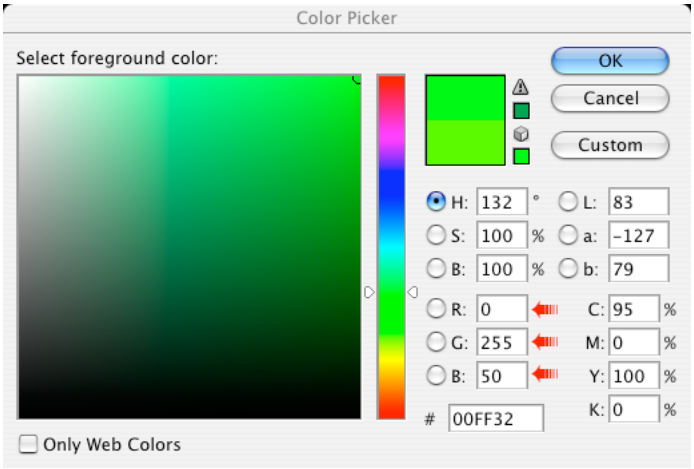

Figure 16.3 Entering The Standard Color Density in the Color Picker to Fill the Layer

Click on the OK button of the Color Picker. Use the Paint Bucket Tool to fill the Standard Color Density Layer with the Standard Color Density you just entered. Make sure the Mode of the Standard Color Density Layer is set to Screen. Now the Tonal Palette will Appear as it does in Figure 16.4.

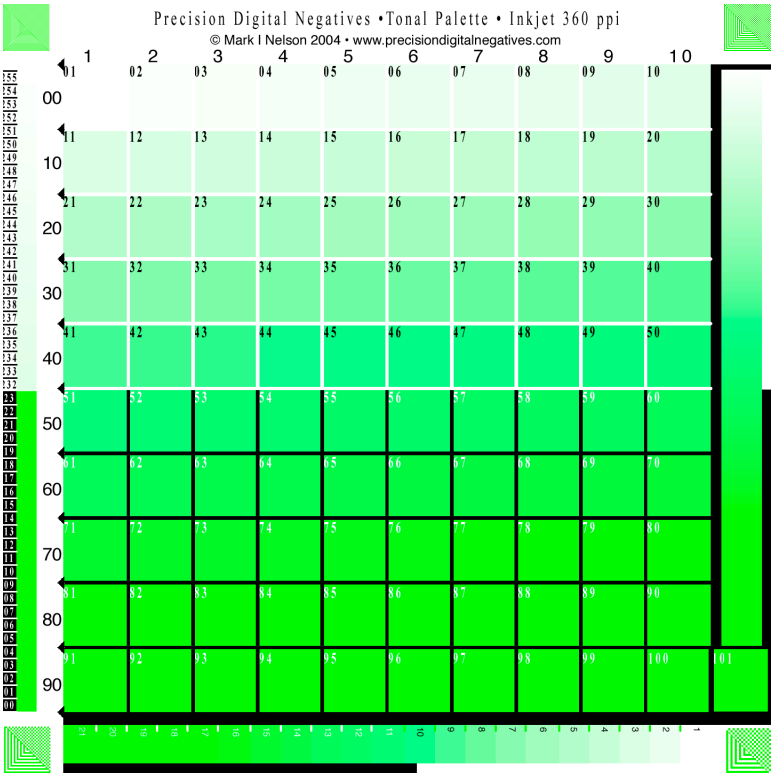

Figure 16.4 The Tonal Palette With the Standard Color Density Applied

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Notice that some parts of the Tonal Palette appear colored now and some parts remain black. This is helpful because the black areas are a very high density and assist you in evaluation of the Tonal Palette once it is printed with the Alternative Process. As you can see the steps of the Tonal Palette have now taken on the hue of the Standard Color Density. Each step has been converted to an equivalent saturation level of this color.

When using the Paint Bucket Tool, be sure that the settings for this tool in the menu bar are as follows:

1. Fill: Foreground
2. Mode: Normal
3. Opacity: 100%

Do not change the order of any of the layers in the file.

Now print the file on the film substrate. Be sure to flip it horizontally or to set your printer driver to Emulsion Side Down. If you print it and find that you forgot to flip it, I would highly suggest printing it again correctly—this will save you a lot of confusion when you enter the data into the Curve Calculator. The text on the printed Tonal Palette should read correctly when you are viewing it from the top with the emulsion side down. Be sure to print it on the emulsion side of the transparency film.

Do not do any of the following to this file:

1. Invert the file to a negative image
2. Change the file mode from RGB to any other mode such as CMYK, Grayscale, etc.
3. Resize the file
4. Add a curve to the file (the curves layer included in the Layers Palette is for later use)
5. Make any other changes to the file

After you have printed the Tonal Palette on the transparency film, handle it carefully. You may want to use cotton gloves and store it in a protective sleeve when it is dry enough. Allow the Tonal Palette ink to cure at least 2 hours. During this time you can coat the 6” x 8” strip of paper that you will use to print with your alternative process. During the curing process, the densities of the Tonal Palette will go down and finally stabilize.

If the Tonal Palette ink is cured and the coated paper is dry, you are ready to make the test print of the Tonal Palette. Be sure that your emulsion is dry before you make the print. It’s very embarrassing to have to peel a negative from your coated paper after an exposure!

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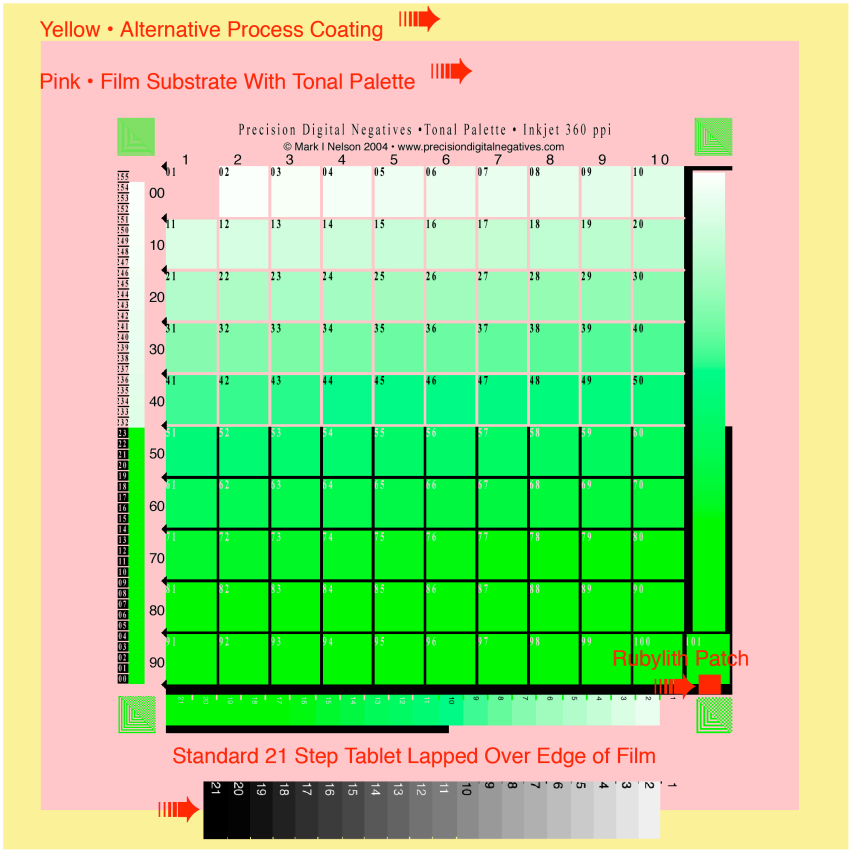
Yellow • Alternative Process Coating
Pink • Film Substrate With Tonal Palette
Precision Digital Negatives •Tonal Palette • Inkjet 360 ppi
© Mark I Nelson 2004 • www.precisiondigitalnegatives.com
Rubylith Patch
Standard 21 Step Tablet Lapped Over Edge of Film

Figure 16.5 Layout for Tonal Palette and Standard 21 Step Tablet

Position the Tonal Palette on the coated paper emulsion side down as shown in Figure 16.5. In this position, the text of the Step Tablet should be oriented so that you can read it. Next, place a Standard 21-Step Tablet next to it lapped over the edge of the film—this is your insurance that the exposure and chemistry are consistent throughout the calibration process. Expose the Step Tablet using the Standard Printing Time you determined earlier.

Add a Color Density Range Palette next to the Tonal Palette. If you wish, you can just use a portion of the Color Density Range Palette. This will be helpful later in evaluation as it will provide confirmation that the Standard Color Density used was correct.

Develop the printed Step Tablet in your normal manner. Be sure to allow sufficient time for the print to dry before evaluating it. Tonal steps may take on additional density for another 24 hours with some processes when the print is air-dried.

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Below is a list summarizing the steps required to make a print of the Tonal Palette using the Standard Density Color and Standard Printing Time:

1. Open the image file of the Tonal Palette called TonalPaletteInkjet.psd in Photoshop™
2. Using the Layers Palette, Select the Layer labeled *Standard Color Density*
3. Click on the Foreground Color icon in the Tool Box
4. Using the Color Picker, set the RGB values to the Standard Color Density values
5. Using the Paint Bucket Tool, fill the Standard Color Density Layer with the Standard Color Density
6. Make sure the Standard Color Density Layer is set to Screen
7. Flip the file Horizontally (*Image>Rotate Canvas>Flip Canvas Horizontally*)
8. Save the file for future reference
9. Print the Tonal Palette on the film substrate using the Printer Setup or
   (If using a service bureau, send the file to the service bureau)
10. Allow at least 2 hours drying or curing time for inkjet Tonal Palettes
11. Coat a 6" x 8" strip of paper with emulsion and let it dry
12. Place the Tonal Palette over the coated strip of paper
13. Place a piece of Rubylith or foil over an area of the negative that is maximum density
14. Place a Standard 21-Step Tablet next to the Tonal Palette
15. Expose the Tonal Palette with your alternative process using the Standard Printing Time
16. Develop, Fix, Wash, etc.
17. Allow sufficient dry down time for the printed tones to stabilize

It is extremely important that a Standard 21-Step Tablet be printed with the Tonal Palette. This will provide valuable information later when evaluating the results. The addition of the piece of Rubylith, foil or some other extremely dense material is a means of checking for fogging and confirming the Standard Color Density has sufficient density to print at or near paper white.

PRINTING THE IMAGESETTER TONAL PALETTE

Below is a list summarizing the steps required to make a print of the Tonal Palette with the imagesetter version of the file:

1. Send the file TonalPaletteImagsetter.psd to the Service Bureau
2. Ask that the file be printed Right Side Reading, Emulsion Side Down.
3. Ask that the file be bitmapped to 1200 DPI and printed with a stochastic screen at 2400 DPI, or 1800 DPI and printed with a stochastic screen at 3600 DPI
4. Check the film with a loupe when you receive it back from the Service Bureau, measure the DMax and record the value for future reference
5. Coat a 6" x 8" strip of with emulsion and let it dry
6. Place the Tonal Palette over the coated strip of paper
7. Place a piece of Rubylith or foil over an area of the negative that is maximum density

8. Place a Standard 21-Step Tablet next to the Tonal Palette
9. Expose the Tonal Palette with your alternative process using the Standard Printing Time
10. Develop, Fix, Wash, etc.
11. Allow sufficient dry down time for the printed tones to stabilize

EVALUATING THE FIRST PRINTING OF THE TONAL PALETTE

Once the printed Tonal Palette is dry, you should examine it to determine if it printed accurately. Typically, the first printing of the Tonal Palette will show blocked up shadow tones as shown in 16.6. This is quite normal and will be adjusted once the Process Adjustment Curve is applied for the second and final printing.

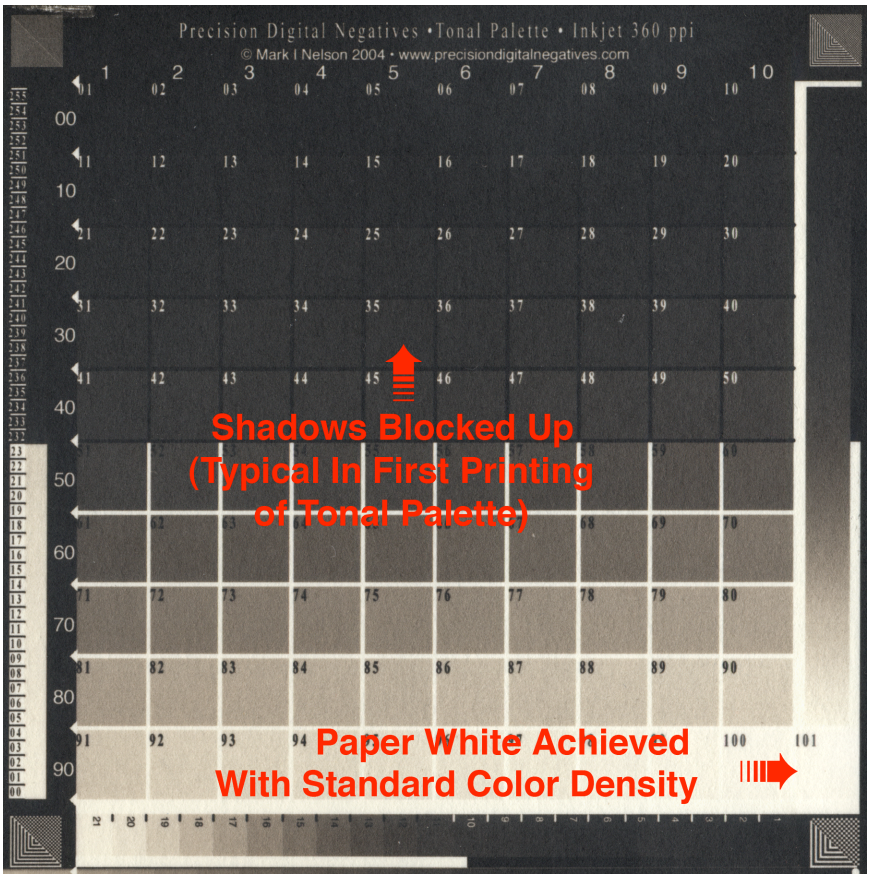
Precision Digital Negatives • Tonal Palette • Inkjet 360 ppi
© Mark I Nelson 2004 • www.precisiondigitalnegatives.com
Shadows Blocked Up
(Typical In First Printing
of Tonal Palette)
Paper White Achieved
With Standard Color Density

Figure 16.6 The First Printing of the Tonal Palette With Palladium

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The Standard Test Tablet

First look at how the Standard 21-Step Tablet printed. It should print with exactly the same number of steps and the same tonal separation that was observed when you printed it with the Color Density Range Palette. If this is not the case, then you will not be able to use this printing of the Tonal Palette to determine the Process Adjustment Curve. Try to determine if there was an error in the Standard Printing Time, chemistry, or some other variable along the way:

- If the step tablet does not show enough tonal steps, then either the printing time was too short or the contrast of the chemistry was too high when compared to the earlier calibration steps.
- If the step tablet shows more tonal steps and possibly merging of steps #1 and #2, then either the printing time was too long or the contrast of the chemistry was too low when compared to the earlier calibration steps.

The Standard Printing Time & The Shadow Steps of the Tonal Palette

If the Standard Printing Time is correct, the Tonal Palette should show the same Dmax in step #1 that was observed when printing the Color Density Range Palette. As stated above, you should also see a fair amount of "blocking up" in the shadow steps or lower steps (Steps #1–#30)—this is normal.

The Standard Color Density & The Highlight Steps of the Tonal Palette

The highlight steps of the Tonal Palette should all show some tone except for step #101. Step #101 should print at or very close to paper white. It should also print exactly as the step of the same Color Density printed when printing the Color Density Range Palette. Sometimes it is difficult to determine if a small amount of tone is present in this step. This is the reason for including a piece of Rubylith or foil over an area of maximum ink density when printing the Tonal Palette. The area thus covered should definitely print at paper white and is an indicator as to whether or not the Standard Color Density chosen has enough density. Another possibility, if the area beneath the swatch does not print paper white, is that fogging has occurred.

If the Tonal Palette has not been overexposed and Step #101 is showing too much tone, then examine the printing of the Color Density Range Palette and determine if perhaps the Color Density one step higher (more dense) should be used. If so, reprint the Tonal Palette using this higher Standard Color Density.

If the steps just below #101 are also printing at paper white and the Tonal Palette was properly exposed, then the Standard Color Density was too high. The Tonal Palette should be reprinted using a lower (less dense) Standard Color Density.

The Sharpness Grids

These checkerboard areas are also a way to measure the ability of your alt photo process to render sharpness. With some emulsions there may not be enough exposure to UV light with such a fine pattern and the detail will come off during development. If there is no way to improve the emulsion so that it will hold finer detail, this might be an indication that a negative of lower resolution would print better without blocking up. In other cases, the texture of the paper may be so great that it will obscure the definition of the finer checkerboard. The checkerboard pattern cannot print any better than the ability of the printer to render it on the negative, thus when examining the print, it is good to compare it to the negative. If the first printing of the Tonal Palette passes all these tests, then you are ready to take the measurements from it that will determine the Process Adjustment Curve.

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Measuring The Printed Tonal Palette

The next step in calibration will provide the information necessary to construct a Process Adjustment Curve that will cause the steps of the Tonal Palette to print in a linearized fashion with even separation throughout the tonal scale—thus giving a printed image that matches the image on the monitor. This curve adjusts for the relative densities of the tonal scale between DMax and DMin. The Process Adjustment Curve controls two aspects of printing. The first is the uneven densities of the ink across the tonal scale. The second is the variations of density of the alternative process itself. The Process Adjustment Curve matches the two so they work in harmony with each other.

There are some issues that may cause problems leading to inaccurate data:

1. Heavily textured paper may give inaccurate readings due to scuffing of the emulsion coating or poorly coated paper. This is due to the "peaks" of the paper texture not having as much emulsion. This "salt and pepper" effect caused by the spots of exposed paper white produces a false reduction in the density readings. This is usually more severe in the denser steps.
2. Thin, translucent papers, such as vellums, require that a sheet of white paper be placed under them for consistent readings. This can be tested by taking readings both with and without the paper underneath the Tonal Palette. Standardize this by using the same paper underneath the Tonal Palette each time. Avoid papers with glossy surfaces that would reflect more light.
3. Uneven coating will cause streaks of variance in the density readings. The most consistent readings have been with paper that was rod coated or coated with the "Magic Brush." However, the best results should come from whatever coating method you plan to use on a regular basis.
4. The paper may print "splotchy" due to uneven sizing.
5. Uneven exposure can also affect the density readings. For example, if using a bank of fluorescent bulbs for exposure and the bulbs are spaced too far apart, there may be a banding effect that will throw the densitometer readings off. This may appear in the reading as a series of plateaus or steps in the data, depending on the orientation of the Tonal Palette to the direction of the bulbs. One way of compensating for this is to rotate the Tonal Palette carefully a few times during exposure.

There are two methods for measuring the steps of the Tonal Palette. I prefer to use a reflection densitometer because I have it connected to my computer and I don't have to enter readings manually. However, if you do not have access to a densitometer, measurements can also be accomplished with a scanner.

Measuring The Densities of the Tonal Palette With a Densitometer

The measurement of the steps of the printed Tonal Palette with a densitometer is fairly straightforward. Once the Tonal Palette is thoroughly dry and the densities stable, each of the 101 steps is measured to determine the log reflection density.

There are two Curve Calculator spreadsheets (Excel™), one for use with a reflection densitometer and one for use with a scanner. These spreadsheets are called *CurveCalculatorDens.xls* and *CurveCalculatorScan.xls*.

The values obtained by measuring the Tonal Palette are then recorded in Grid A of (Tab B—Densitometer Data Entry) of the Curve Calculator spreadsheet. This entry grid is covered in a later section. Values should be entered with two decimal places, e.g. 1.25.

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Here are some suggestions regarding taking these readings:

1. Make sure the Tonal Palette is dry so the tonal densities of the steps are stabilized.
2. Make sure there is no dust on the Tonal Palette.
3. Print the Tonal Palette Data Form located in the Curve Calculator, Tab B.
4. Make sure the densitometer is calibrated for accurate readings.
5. Do not *Zero* the densitometer on paper white, or DMin.
6. Set the densitometer to measure in Reflection Mode.
7. Set the densitometer so readings appear in Visual Mode, rather than RGB Color Mode or Autocolor Mode.
8. When reading the steps, check for consistent readings within each square by taking more than one reading. If readings are inconsistent, average 2 or 3 readings.
9. Start with step #1 and take a reading. Record the reading on the Tonal Palette Data Form.
10. Move to step #2 and take a reading and record it.
11. Following this procedure, measure and record all 101 steps of the Tonal Palette.
12. Do not be surprised if the readings seem to fluctuate somewhat in sort of a stair step or roller coaster manner as you measure successive steps. Unless this is severe, the Curve Calculator will account for this.

Now that you have completed all the measurements of the Tonal Palette with the densitometer, you are ready to enter the data into the Curve Calculator and determine your custom Process Adjustment Curve.

Measuring The Densities of the Tonal Palette With a Scanner

The measurement of the Tonal Palette can be accomplished easily with a scanner. Instead of taking log reflection densities, the scanner will give tonal level values (0–255). The data gathered from the scan of the Tonal Palette should be entered into the Curve Calculator using the Excel™ spreadsheet *CurveCalculatorScan.xls*.

The following steps describe the scanning and measurement of the Tonal Palette.

1. Make sure the Tonal Palette is dry so the tonal densities of the steps are stabilized.
2. Make sure there is no dust on the Tonal Palette.
3. Print the Tonal Palette Data Form from the Curve Calculator, Tab B.
4. Record the readings on the Tonal Palette Data Form.
5. Turn on the scanner and let it warm up. Running a "warm–up" scan or two will make sure that the scanner is ready and reading accurately.
6. Set the scanner software to scan 16-bit grayscale at 300 ppi.
7. Do not use any auto settings or adjustment curves when scanning the Tonal Palette. I use the Photoshop™ TWAIN plugin that came with my scanner—it does a great job. Figure 16.7 shows the setup for the TWAIN plugin.

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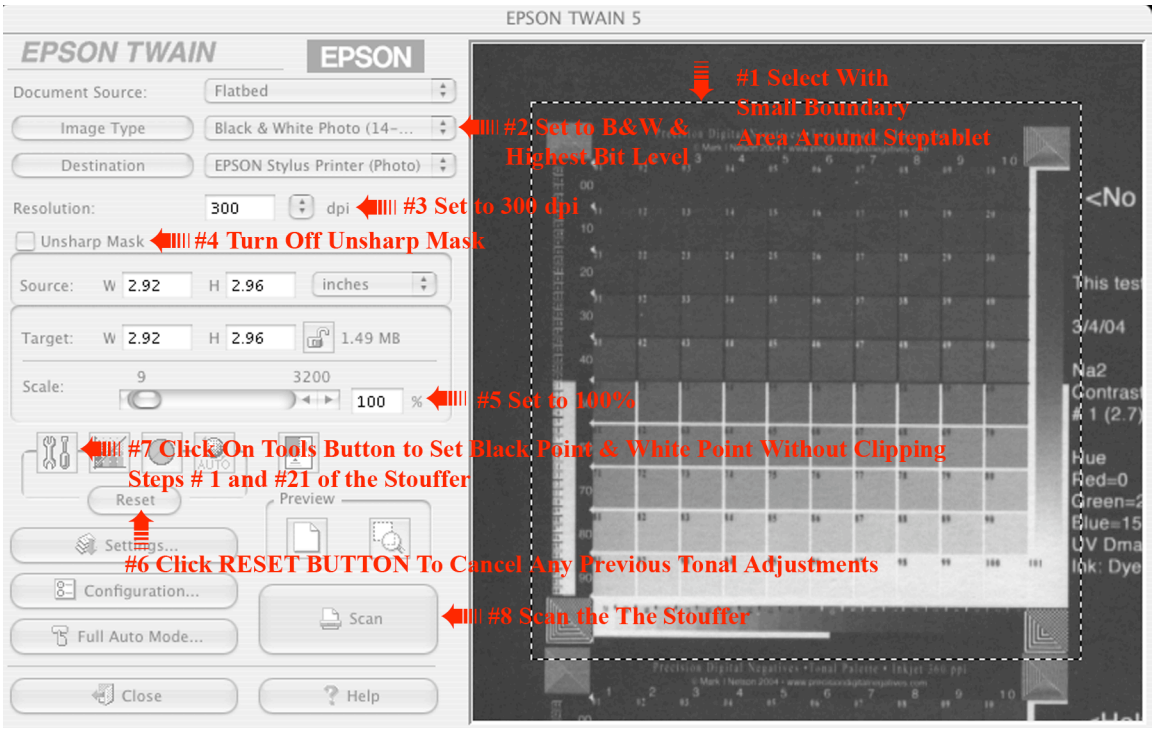

Figure 16.7 Scanner Setup When Scanning the Tonal Palette

8. Use manual settings when setting the Black and White points so that all the steps of the Tonal Palette will fall just within these endpoint settings. This is the only adjustment setting that should be done. Figure 16.8 shows these settings for the Twain Driver.
9. Scan the Tonal Palette and save the file.
10. Open the file of the Tonal Palette scan in Photoshop™.
11. Set Photoshop™ Guides just above the bottom of each row of steps.

Figure 16.8 Twain Black & White Point Settings

12. Examine the scan of the Tonal Palette to make sure that it is a clean scan. If there are dust spots, either spot them with the Healing Brush Tool or use a light application of Dust & Scratches Filter to eliminate spots that will throw readings off.
13. Zoom in on Step #1 of the Tonal Palette.

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14. Using the Selection tool, select a square within the boundaries of step #1 as shown in Figure 16.9, but do not include the number of the step.

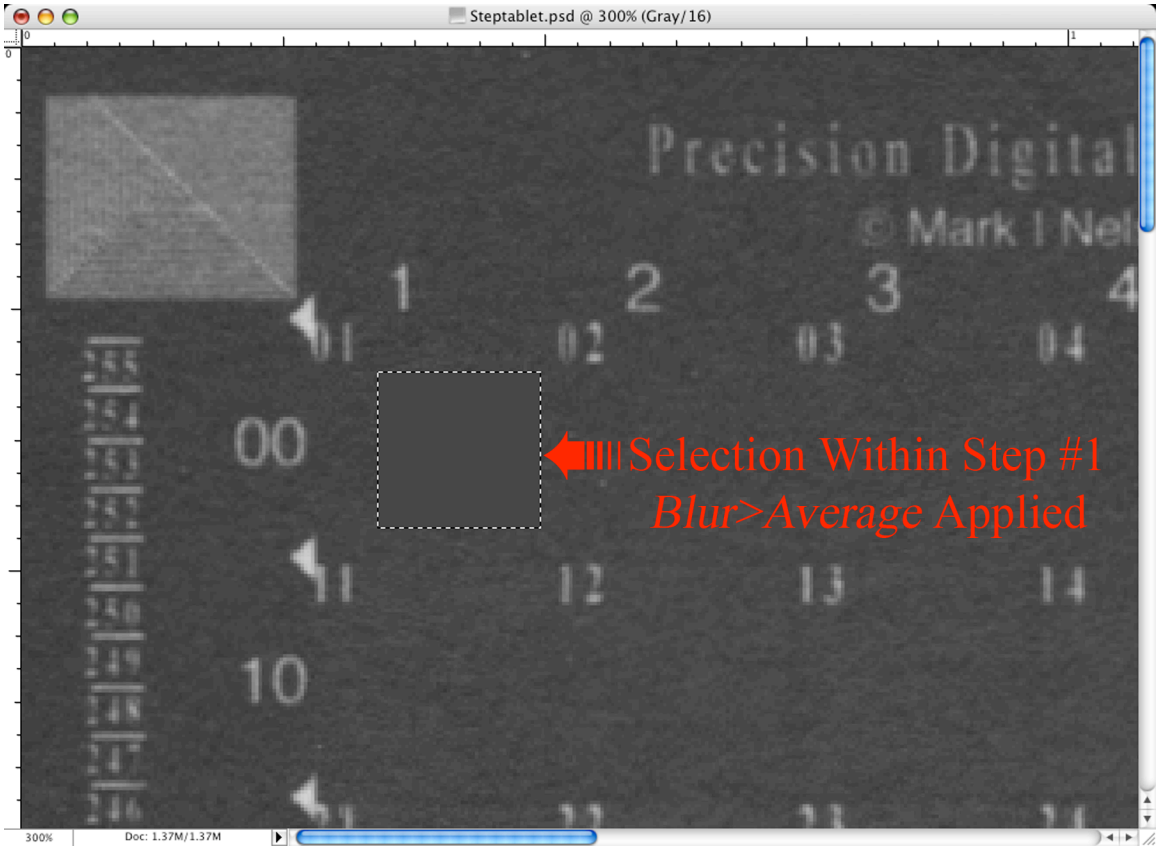

Figure 16.9 Using Blur>Average On a Selection of Step #1 to Obtain an Average Reading

15. Apply the Average Filter (*Filter>Blur>Average*), which will convert all the selected pixels to an average tonal value.
16. Move the selection rectangle to Step #2 and apply the Average Filter again. The average filter can be repeated from the keyboard with *Command+F*.
17. Repeat this procedure of moving the selection rectangle and running the *Blur>Average* filter until you have processed all 101 steps of the Tonal Palette.
18. Now the file is ready to set the Black Point and White Point such that one step of the Tonal Palette will be absolute black (Level 0) and one step will be absolute white (Level 255). The darkest steps of the Tonal Palette will have some fluctuations that may preclude using step #1 to set the Black Point. The following method of setting Black and White points will account for this.
19. Make sure the entire Tonal Palette is visible on the screen.
20. Create a new Adjustment Layer for Levels Adjustment (*Layers>New Adjustment Layers>Levels*).
21. When the Adjustment Layers Window appears, move it so that it does not cover any of the Tonal Palette.

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22. Set the Black Point: Hold down the Option Key on the Mac (Alt Key in Windows) and slide the Black Point Triangle in the Levels Adjustment Histogram slowly to the right. The entire image will turn White. Keep sliding the triangle to the right until just one of the squares in the tonal palette turns Black as shown in Figure 16.10. Next use the Black Point Eyedropper to click on the averaged square within that that step to set it as the Black Point value. Note that in the example, step #1 just happens to be the darkest step—this will not always be true, since coating or uneven exposure may cause some other step to be the darkest. Usually the darkest step will be in the row that contains step #1.

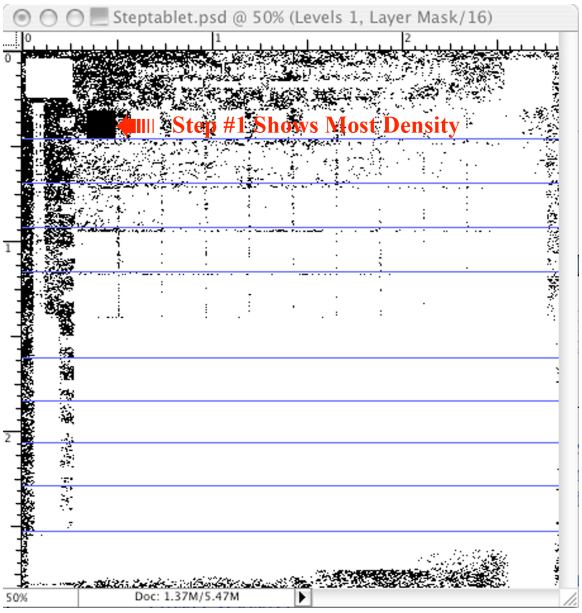

Figure 16.10 Using Levels Adjustment Layer Black Point Slider With Option Key to Find Darkest Step

23. Set the White Point: Hold down the Option Key on the Mac (Alt Key in Windows) and slide the White Point Triangle in the Levels Adjustment Histogram slowly to the left. The entire image will turn Black. Keep sliding to the left until you reach the point where just one square on the Tonal Palette turns White. Next use the White Point Eyedropper to click on the averaged square within that that step to set it as the White Point value.
24. Click the OK button on the window.
25. Next, open the Info Palette (*Window>Info*) and place the Info Palette to the side so it does not cover any of the scan of the Tonal Palette.
26. Select the Eyedropper Tool from the Tool Palette.
27. Starting with step #1, place the eyedropper over the square within step #1 that was "averaged". Determine the value of the tone of that area from the Info Palette and record it on the Tonal Palette Data Entry Sheet Form for step #1.
28. Move to step #2 and follow the same procedure.
29. Measure all 101 steps of the Tonal Palette in this manner and record them.
30. The hard work is done!

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Now that you have completed all the measurements of the Tonal Palette with the scanner, you are ready to enter the data into the Curve Calculator and determine your custom Process Adjustment Curve.

USING THE CURVE CALCULATOR TO DETERMINE THE PROCESS ADJUSTMENT CURVE

The Curve Calculator, which you will find on the CD, is an Excel spreadsheet that comes in two versions—one for use with a densitometer (CurveCalculatorDens.xls) and one for use with a scanner (CurveCalculatorScan.xls). The features are basically the same.

Each time you use the Curve Calculator, make a copy of the file for a new project and fill it out. Save it with a name that makes sense to you, then you have a record of all the information on each of the curves you have developed.

The Curve Calculator has a number of sheets that are accessed by the tabs at the bottom of the window. These Tabs are placed in the order you will use them.

ENTERING YOUR DATA IN THE TONAL PALETTE DATA ENTRY SHEET—TAB C

Open the Curve Calculator and click on **Tab C – Tonal Palette Data Entry**. Enter the log reflection readings (or if you are using the Scanner Method, enter the level readings) you have taken from the printed Tonal Palette into Grid A. The layout of Grid A matches the order of the steps of the printed Tonal Palette as shown in Figure 16.11.

		Data From First Printing of Tonal Palette With No Process Adjustment Curve Applied									
		1	2	3	4	5	6	7	8	9	10
Grid A	00	1.41	1.44	1.47	1.46	1.46	1.48	1.46	1.46	1.48	1.47
	10	1.41	1.42	1.46	1.45	1.44	1.44	1.45	1.43	1.43	1.45
	20	1.42	1.46	1.42	1.42	1.42	1.43	1.41	1.42	1.43	1.42
	30	1.40	1.42	1.40	1.41	1.40	1.42	1.40	1.42	1.39	1.37
	40	1.38	1.37	1.38	1.37	1.37	1.35	1.35	1.34	1.31	1.30
	50	1.28	1.26	1.24	1.23	1.20	1.19	1.15	1.14	1.08	1.05
	60	1.02	0.97	0.95	0.92	0.88	0.84	0.80	0.75	0.73	0.67
	70	0.66	0.63	0.60	0.59	0.54	0.52	0.49	0.45	0.41	0.37
	80	0.35	0.33	0.30	0.27	0.25	0.22	0.21	0.19	0.18	0.16
	90	0.13	0.13	0.11	0.11	0.10	0.09	0.09	0.08	0.08	0.07
	101	0.07									

Data From Step #1 of Tonal Palette

Data From Step #55 of Tonal Palette

Figure 16.11 Tonal Palette Data Entry Form in the Curve Calculator Spread Sheet Showing Densitometer Values

It is extremely helpful to use reference numbers for the Tonal Palettes, Curve Calculator Data and Process Adjustment Curves you develop. This reference number can be printed with a pencil on the back of a Tonal Palette, along with any other information about the printing data that is useful to you. You can use a variety of schemes for this that may include such things as an abbreviation of the process name, date, paper, etc. You will find this very helpful if you wish to go back and review your information and make comparisons with subsequent printed Step Tablets.

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You may also wish to use this reference number when naming the Adjustment Curve you develop. It is no fun to try to figure out what you were doing 3 months ago when you named a curve "DamnGoodCurve.avc".

EXAMINING THE DENSITY READINGS WITH THE CURVE VALUE LOCATOR—TAB D

This sheet provides the information required to develop the Process Adjustment Curve. The graph shows the actual measured values of each of the steps on Tonal Palette and compares them with the target values for the steps of a Tonal Palette having linearized steps as shown in Figure 16.12. A Tonal Palette with linearized steps is one that prints with tonal step values that match the image of the Tonal Palette on the monitor and the steps would differ by an equal log density value. This linearization is achieved with the Process Adjustment Curve. There is a third line in the graph that is a smoothed version of the data you entered. This line is helpful since it averages out the readings and accounts for fluctuations that might be false values. In the illustration below, the curved line of the data measured from a Tonal Palette, and the smoothed version of this data curve are shown compared with the linearized target values.

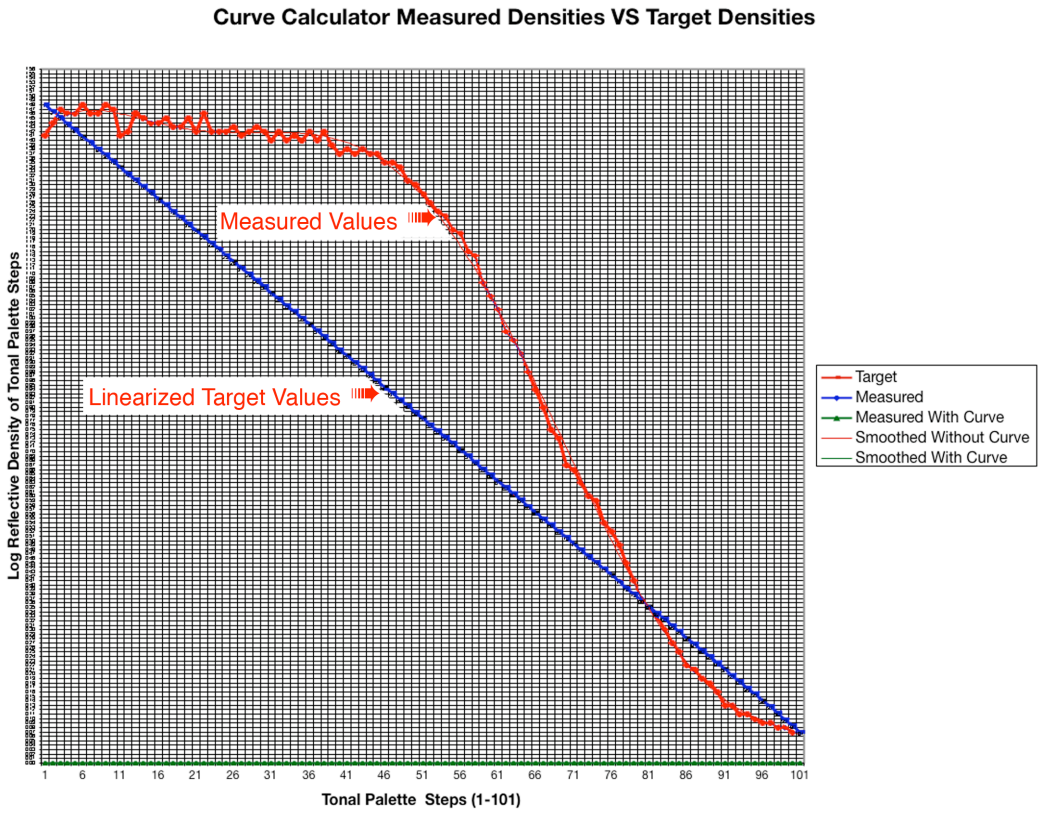
Curve Calculator Measured Densities VS Target Densities
Measured Values
Linearized Target Values
Log Reflective Density of Tonal Palette Steps
Tonal Palette Steps (1-101)
1 6 11 16 21 26 31 36 41 46 51 56 61 66 71 76 81 86 91 96 101
Target
Measured
Measured With Curve
Smoothed Without Curve
Smoothed With Curve

Figure 16.12 Curve Locator Graph of Tonal Palette in the Curve Calculator Spread Sheet

Notice the shape of the density values for the example process. As expected, the steps on the left of the graph, starting with the data from step #1 of the Tonal Palette, show the highest printed density and density gradually declines as you go to the right until you reach DMin, or the least dense step, #101. This is a typical shape for the data gathered from a Tonal Palette.

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The straight line, or Blue Target Density Line, has a series of tick marks on it, one for each step of the Tonal Palette. Every fifth tick mark is indicated in Black. These tick marks represent the twenty-one values that this system uses to define points on a Process Adjustment Curve. Twenty-one points may seem arbitrary, however this represents just slightly more than the sixteen points that can be entered in a curve—you pick the sixteen of the twenty-one points that give the best curve. In addition, if there were more than twenty-one points, the points would be too close to each other to be entered into the Curves Adjustment in Photoshop™.

This graph of the density readings can also indicate problems in the printing of the Tonal Palette that were discussed earlier in the section *Evaluating the First Printing of the Tonal Palette*.

If the area of denser readings, the shadows starting at step #1, is flat for quite a number of steps, then it is likely that you have over exposed your Tonal Palette. Compare the printing of the Standard 21-Step Tablet done with the Tonal Palette to the one done with the Color Density Range Palette. This will indicate any change in exposure. If they are not the same, then print the Tonal Palette again with the correct Standard Printing Time. If you don't do this, you will end up with a curve that really plays havoc with the tones of your images.

If the area of least density, the highlights starting at step #101, shows a long, flat area with little change, Then the Step Tablet was either under exposed or, (depending on the process) the contrast mixture was too high, or the Standard Color Density was too high. Compare the printing of the Tonal Palette with the printing of the Color Density Range Palette.

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USING THE CURVE VALUE LOCATOR TO FIND CURVE ADJUSTMENT VALUES – TAB D

The Curve Value Locator shows the printed density of each of the 101 steps of the Tonal Palette negative. It also shows the target density for each of those steps. The objective of the Process Adjustment Curve is to get a given step to print the predicted target value, rather than the current measured value. The chart of the Curve Value Locator can be zoomed in Excel to 400% to make the process easier to complete. Figure 16.13 shows an enlarged view of the Curve Value Locator and the method for locating values for the curve.

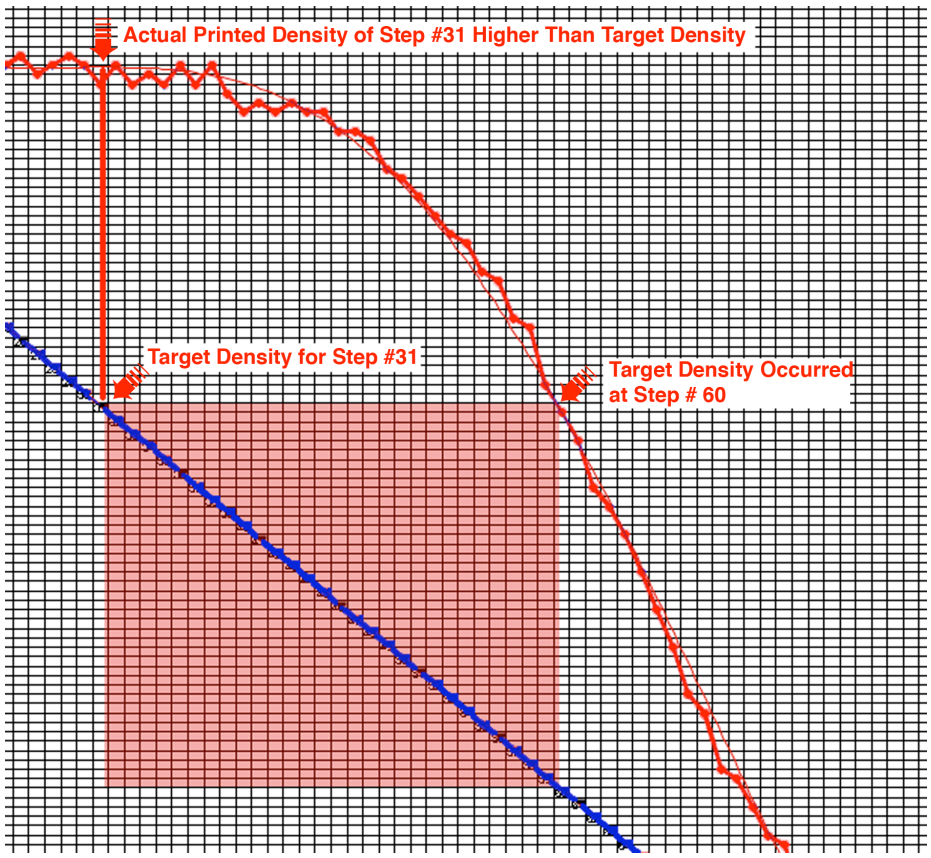
Actual Printed Density of Step #31 Higher Than Target Density
Target Density for Step #31
Target Density Occurred at Step # 60

Figure 16.13 Curve Value Locator Showing Step #31 Printed Density VS Target Density

For each tick mark on the Blue Target Density Line, you can locate a point on the curve of the actual printed densities that did print with the desired density. By determining the step that actually produced the target printed density for a given tick mark, you find the required negative density to produce the desired print density. Figure 16.13 shows how step #31 of the Tonal Palette printed with too much density. However, by tracing horizontally from the step #31 tick mark, you can locate the step of the Tonal Palette negative that did have the proper density for step #31, which is step #60. This tells how much step #31 needs to be adjusted to print properly. Step #31 of the Tonal Palette negative needs to be adjusted by the Process Adjustment Curve so it has the density of Step #60.

These adjustments can be determined for each of the 19 Black Tick Marks on the straight Blue Target Density Line. To make this easy, the transparent red rectangle that appears on the face of the Curve Value Locater Graph can be moved around, stretched, and aligned as it is in Figure 16.13.

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Here the rectangle was moved so the top bisected the tick mark for Step #31. Then the rectangle was stretched to the right until it intersected with the curved line representing the actual printed densities. The rectangle was then stretched down to the base of the chart to find the corresponding step for the actual printed density. Record these values for each of the tick marks.

The X-axis values representing the 101 steps of the Tonal Palette fall between the vertical gridlines as shown in Figure 16.14.

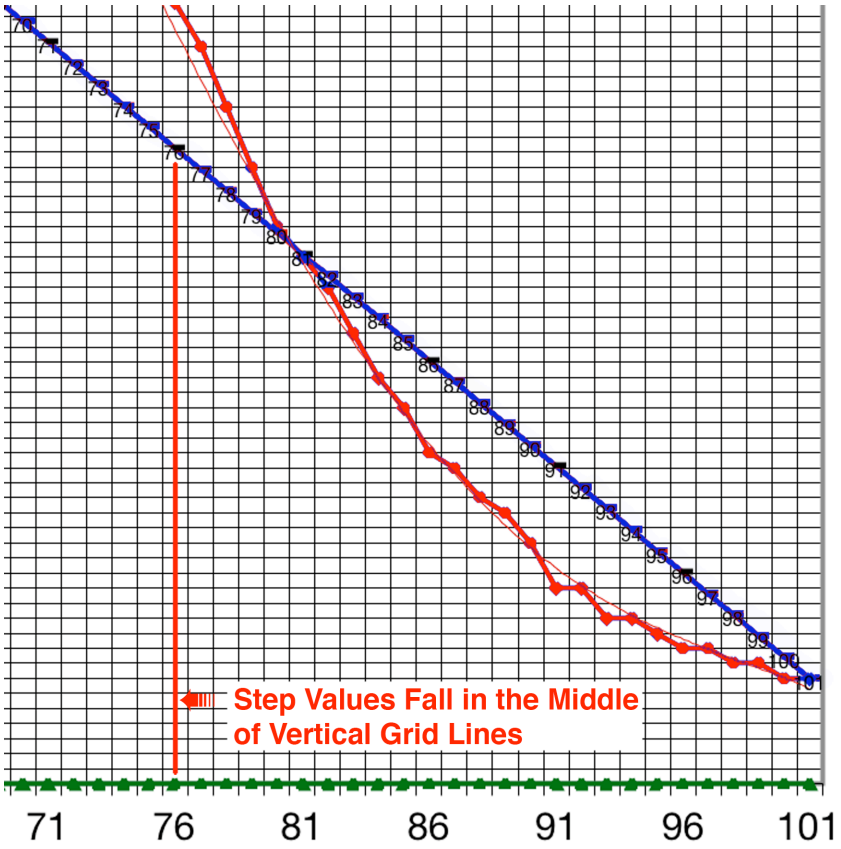

Figure 16.14 Curve Value Locator and Location of Step Values

The X-axis values show only the numbers associated with the Black Tick Marks, which are the 21 values used to determine potential curve points. Thus in Figure 16.14, the values for steps #77, #78, #79, and #80 would fall between 76 and 81.

Often upon positioning the right vertical edge of the transparent rectangle when locating values, the desired point may not fall exactly in the middle of a specific step. If not, then you can adjust for this in the following manner. For example, if you have a value that falls between step #76 and #77 you can divide the distance between the steps into tenths such as 76.1, 76.2, 76.3, etc. and record the value in that format. This may seem picky, but it will make a slight difference in your curve.

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The tick marks on each end, #1 and #101, should not be used to determine an adjustment. These tick marks represent the endpoints of the curve at values 0 and 255 and they should never be changed—these two points are already *zeroed* by the Standard Printing Time and the Standard Color Density. Only points between the endpoints on the Curve Adjustment should be changed. The Tonal Palette Data Form provides a grid for you to record the values for each of the remaining 19 tick marks (Black Tick Marks) on the target line. Steps #1 and #101 are already filled in, since they should remain unchanged.

Determining the Process Adjustment Curve Input & Output Values – Tab E

This next step of the calibration is the conversion of the step values you have just determined into numbers that can be used for input and output values in the Photoshop™ Curves Adjustment. The input and output values are tonal levels ranging from 0–255. The values from the Tonal Palette Data Form are entered in the matching column with the same heading as shown below in Figure 16.15.

X Axis Values On Chart	Tonal Palette Step # (Black Tick Marks)	ENTER Below The Tonal Palette Step With Correct Density	Photoshop Curve INPUT Values	Photoshop Curve OUTPUT Values	Enter Tweaker Values Below	Tweaked Photoshop Curve Output Values
1	1	1.00	255	255	Do Not Use	255
2	6	27.00	242	189		189
3	11	47.00	230	138	10	148
4	16	51.50	217	126		126
5	21	55.00	204	117		117
6	26	57.50	191	111		111
7	31	59.70	179	105		105
8	36	62.00	166	99		99
9	41	64.00	153	94		94
10	46	66.00	140	89		89
11	51	68.00	128	84		84
12	56	70.00	115	79		79
13	61	72.00	102	74		74
14	66	74.30	89	68		68
15	71	77.00	77	61		61
16	76	78.50	64	57		57
17	81	81.00	51	51		51
18	86	83.50	38	45		45
19	91	87.00	26	36		36
20	96	91.00	13	26		26
21	101	101.00	-	-	Do Not Use	-

Figure 16.15 Entering Curve Values in Grid in Tab E of Curve Calculator

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As you enter the data, you will see the curve begin to take shape in the inset chart above the entry column as shown in Figure 16.16. The inset chart shows a straight Blue Line that corresponds to the Curve Adjustment Input Values in the Photoshop Curves Dialogue Box Window. The Curve Adjustment Output Values are computed from the data you have entered and are represented by the Green Curve and the Orange Curve (Tweaked Values).

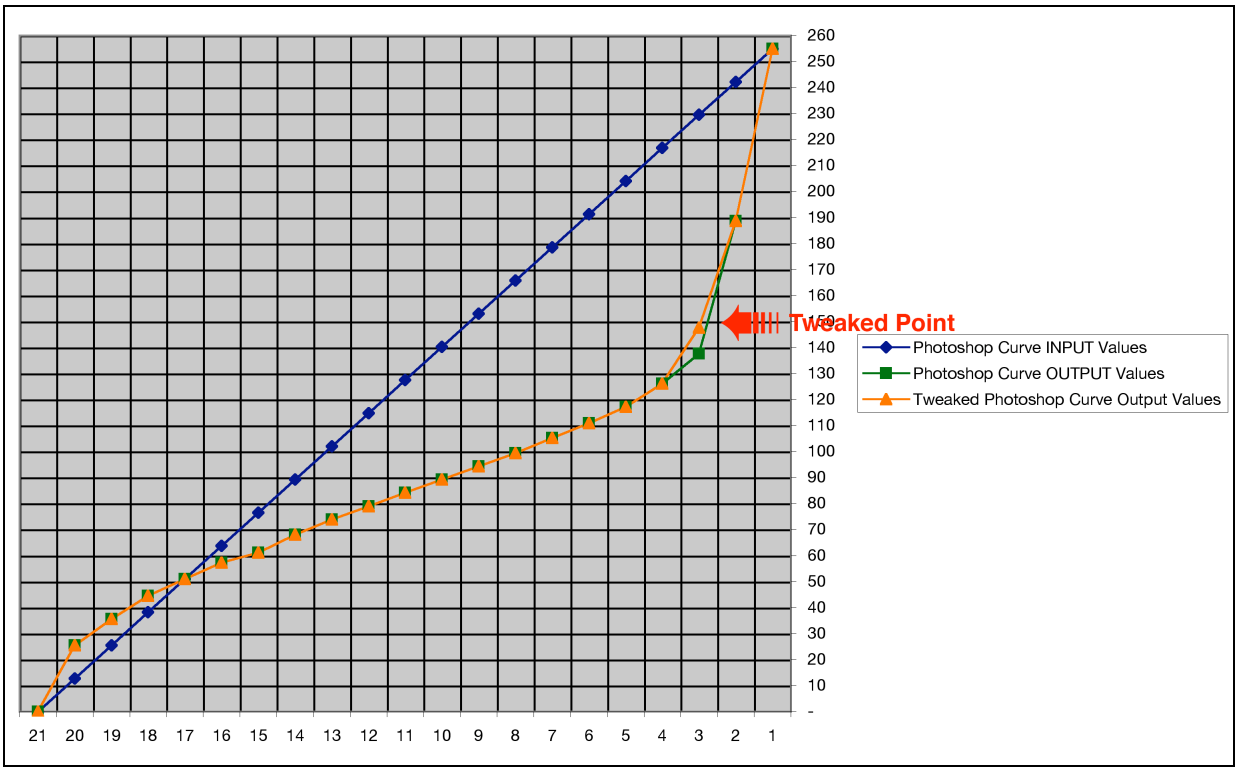

Figure 16.16 The Curve Points Showing One Point That Has Been Tweaked

There is another column that you may want to use at some point. This is the "Curve Tweaker" column. This column lets you adjust points on the curve up or down. The values are all preset to 0 so that the Tweaker will not initially affect any of your data. You "Tweak" curve points by entering a positive integer to raise a point, a negative integer to lower a point, or 0 to keep a point where it is. You may have to play with it a bit to get the feel of it. The results of the Curve Tweaker are shown as an Orange Curve in the Chart. If you have a point on your curve that seems "out of line," or too drastic, you can make adjustments to it with the Tweaker Column. You can also use the Tweaker to adjust the entire curve more to your liking by changing the values in the Tweaker Column for all the points except the two endpoints, however I prefer to use a second adjustment curve to do this. Remember, if you use the Tweaker, and you want those tweaked values for your curve, then the Orange Column of numbers under the heading "Tweaked Curve Output Values" will become your correct Curve Output Values. Otherwise, use the Green Column of values with the heading *Photoshop Curve Output Values*.

Note that if you do not enter any values in the Tweaker Column, the orange curve of the Tweaked Curve will be exactly the same shape and cover the Output Values (Blue Curve).

After you have filled out all the cells of the column, print this sheet and save the file.

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ENTERING THE PROCESS ADJUSTMENT CURVE VALUES IN PHOTOSHOP™

Open Photoshop™ and the Tonal Palette file that you saved from first printing of the Tonal Palette. This file has the Standard Color Density Layer you used already applied. To enter your curve adjustments for the Process Adjustment Curve you have just calculated, open the Layers Palette and double click on the layer Process Adjustment Curve. Next, set up the Curves Adjustment Window as described below:

1. Hold down the Option Key on the Mac (Alt Key in Windows) and on the grid of the Curves Adjustment Window. This will toggle the grid back and forth between a 4x4 grid and a 10x10 grid. Leave it set at a 10x10 grid.
2. Click on the little graduated fill containing a tiny black and a tiny white triangle beneath the grid. This toggles the shadows and highlights of the grid, but most important, if you have it set with the shadows on the left, the two boxes where you define the input and output levels for a point shifts from Percentages to Levels (0-255).
3. Next, enter your curve adjustment points by clicking on the curve line to establish a point. Once you do this, you will see the Input Value and the Output Value of the point appear in the lower left hand corner of the window inside small boxes. *Double Click* on the Input Value box and then enter the Input Value for the Adjustment Point you are defining. Now *Tab* to the Output Value box and enter the Output Value for the point. Continue to do this until you have entered 14 adjustment points.

Since there are only 16 adjustment points allowed on an adjustment curve (including the endpoints, which won't be changed), there are only14 adjustment points to enter. The Curve Calculator provided data for 19 points (excluding the endpoints). There are 4 points in the midtones that are optional and have been grayed out in the Curve Calculator. The midtones usually do not need as much adjustment as the shadows and highlights as is shown in Figure 16.17.

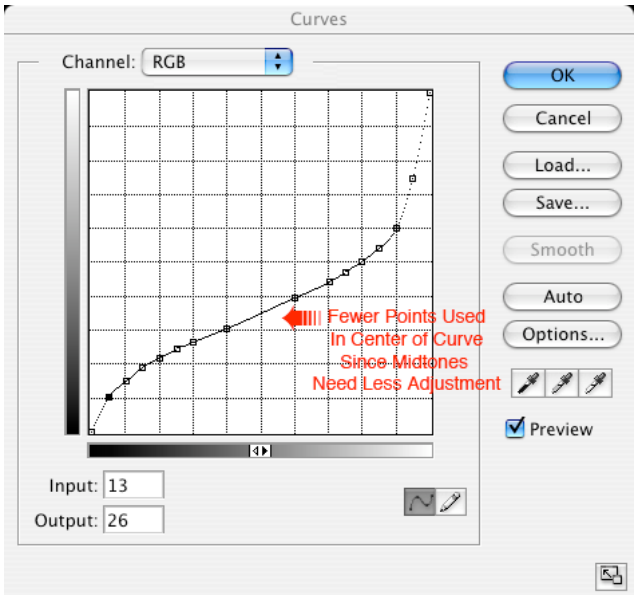

Figure 16.17 The Curve as Entered Into Photoshop™

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Eliminating the grayed-out points leaves 15 points that you have determined to be the most important points to adjust on your custom curve. Still, you will need to eliminate one of them. The best way to decide which one to eliminate is enter as many of the data points as you can and examine the curve. Pick one of the points that falls in an area where the gradient or adjustment of the curve is the least drastic and eliminate that point. Be sure not to leave too large a gap between any two points. Figure 16.17 shows a completed Process Adjustment Curve.

Adjustment points on the curve can be removed by simply dragging them outside the grid. When a point is clicked on or selected, you can use the Up and Down Arrow Keys on the keyboard to nudge them Left or Right when the Input Value is highlighted. If the Output Value is highlighted, the Up and Down Arrow Keys nudge the point Up and Down.

If you are using an older version of Photoshop™ that does not support Adjustment Layers, then be sure to save the Curve Function you just entered before closing the Curves Adjustment Window. Once the curve is entered, save the file with a new name and then print it on film following the same steps as for the first printing of the Tonal Palette on film.

PRINTING THE SECOND TONAL PALETTE

Now that you have created your first curve, you are probably anxious to try it on an image. Before you do that, it would be advisable to use your curve to do a second printing of the Tonal Palette. There are two reasons for doing this. First, and most important, to confirm that the curve works! Second, if it does work properly, you have a wonderful Tonal Palette to use as a guide later when making your images. This second and final Tonal Palette is extremely helpful in deciding how you want to place the tones of your image when making prints.

Be sure to keep all variables constant when doing the second printing of the Tonal Palette. Refer to your notes from the first printing. The only difference in your workflow should be the Process Adjustment Curve you are applying to the Tonal Palette. Be sure to print a Standard 21-Step Tablet along with the Tonal Palette and the portion of the Color Density Range Palette that includes the Standard Color Density you are using—this allow you to determine if printing is consistent with earlier calibration steps.

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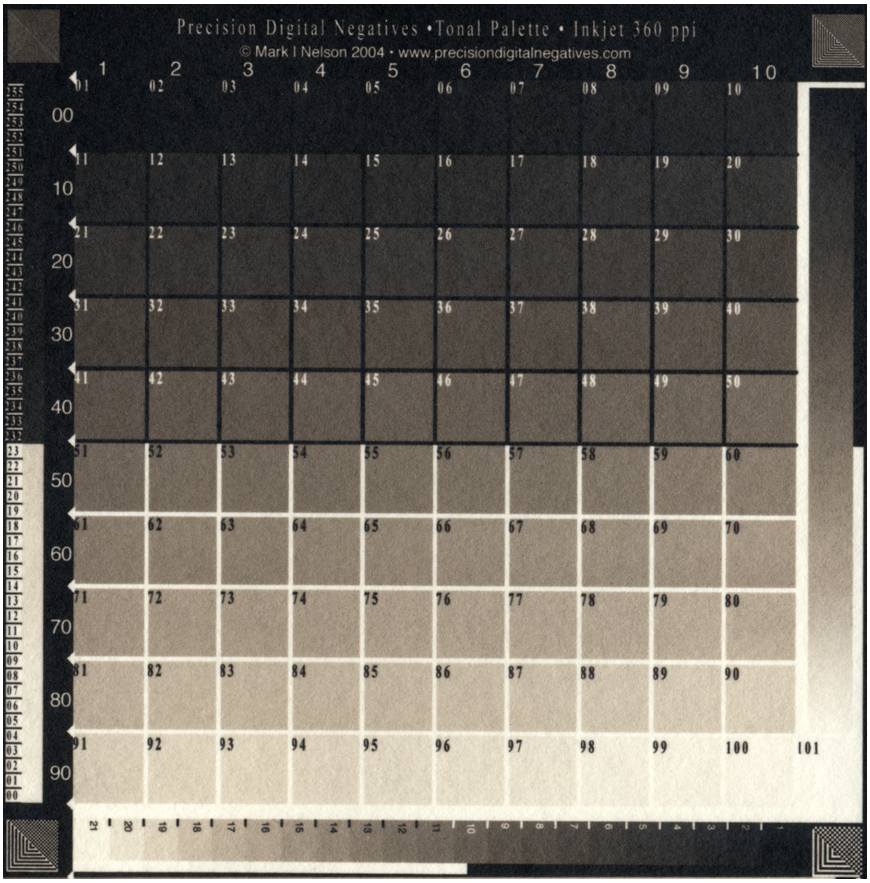

Figure 16.18 The Second Printing of the Tonal Palette

Figure 16.18 shows a second printing of the Tonal Palette with the Process Adjustment Curve applied. Notice how the shadows have opened up when compared to the first printing of the Tonal Palette.

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The Curve Calculator's Tonal Palette Data Entry Sheet (Tab C) has a second entry grid, Grid B, which is provided for the values derived from the second printing of the Tonal Palette with the curve applied. Once you have entered the data, you can compare the results by going to Tab D, Curve Value Locator. The second set of data will be graphed for you with a green line or curve. If all has worked according to plan, the data of this line should come close to emulating the straight, blue diagonal line—the target values. Figure 16.19 shows a graph from the Curve Calculator comparing the first and second printings of the Tonal Palette.

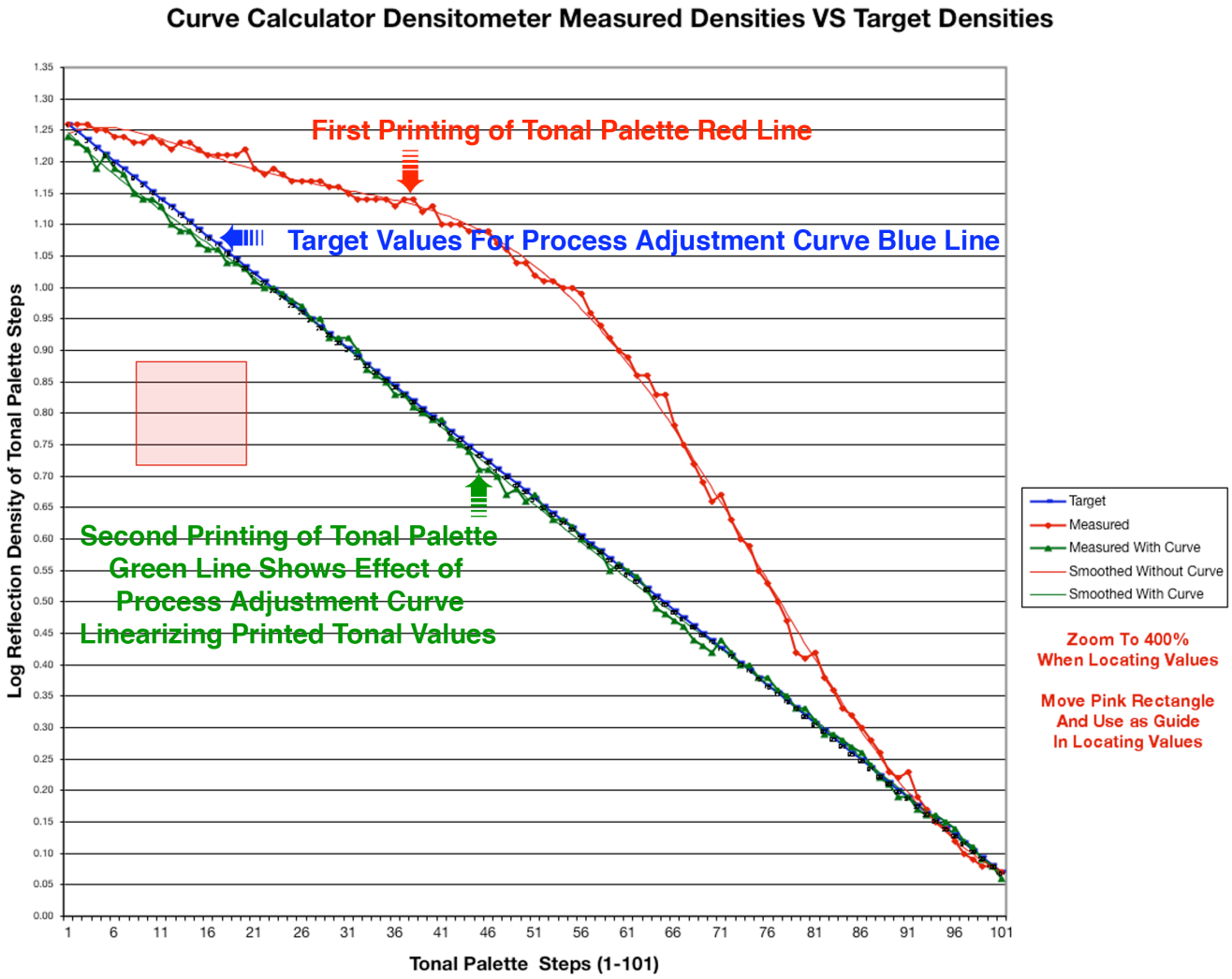
Curve Calculator Densitometer Measured Densities VS Target Densities
First Printing of Tonal Palette Red Line
Target Values For Process Adjustment Curve Blue Line
Second Printing of Tonal Palette
Green Line Shows Effect of
Process Adjustment Curve
Linearizing Printed Tonal Values
Log Reflection Density of Tonal Palette Steps
Tonal Palette Steps (1-101)
Target
Measured
Measured With Curve
Smoothed Without Curve
Smoothed With Curve
Zoom To 400%
When Locating Values
Move Pink Rectangle
And Use as Guide
In Locating Values

Figure 16.19 The Curve Calculator Comparison of First & Second Printing of Tonal Palette Showing the Effect of Process Adjustment Curve

If the green line on the graph doesn't closely emulate the Blue Target Line, then you need to evaluate what might have gone wrong. Were all variables kept the same?

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Does the printing of the Standard 21-Step Tablet look/measure the same in both printings of the Tonal Palette, with and without the curve? It should. If it doesn't, then you have a problem that relates to consistency in your exposure, coating, or chemistry of your alt process.

For other problems, you might check the following:

1. Did you print the Tonal Palette negative correctly as described?
2. Did you measure the steps correctly?
3. Did you enter the data correctly into the Curve Calculator?
4. Did you enter the values correctly in the Photoshop Curves Function?
5. Did the curve, once entered into the Curves Function look relatively smooth?
6. Did you use the same printer settings for printing the adjusted Tonal Palette?
7. Did you mistakenly convert the inkjet version of the Tonal Palette to grayscale?
8. Did you mistakenly invert the file of the Tonal Palette?
9. Did you make any other adjustments to the Tonal Palette file other than applying the curve you calculate?
10. Did you fudge somewhere?

If you were using an imagesetter, Lightjet, Lambda or Chromira version of the Tonal Palette, check with the vendor to make sure that both the first and second printings of the Tonal Palette were done in the same manner. Be careful that there wasn't an embedded profile in one or both of the files used for the film outputs that caused different results. Remember, they are to print the files as they are, with no profiles or inversion of the file! Note that some vendors are better than others in calibrating their machines and chemistry. One way you can do a partial check is to take density readings on the film negatives for the first and second Tonal Palettes to see if they have the same DMax.

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TAKING THE GUESSWORK OUT OF CALIBRATION

When going through the calibration process, you can save time and confusion by a cumulative approach that includes all previous calibration items in the printing. In the four major stages of the calibration process, the items would be:

- Stage 1: Standard 21-Step Tablet
- Stage 2: Standard 21-Step Tablet + Color Density Range Palette
- Stage 3: Standard 21-Step Tablet + Color Density Range Palette + Tonal Palette
- Stage 4: Standard 21-Step Tablet + Color Density Range Palette + Tonal Palette with Process Adjustment Curve applied

By the time you reach Stage 4, the layout of items to be printed would look like Figure 16.20.

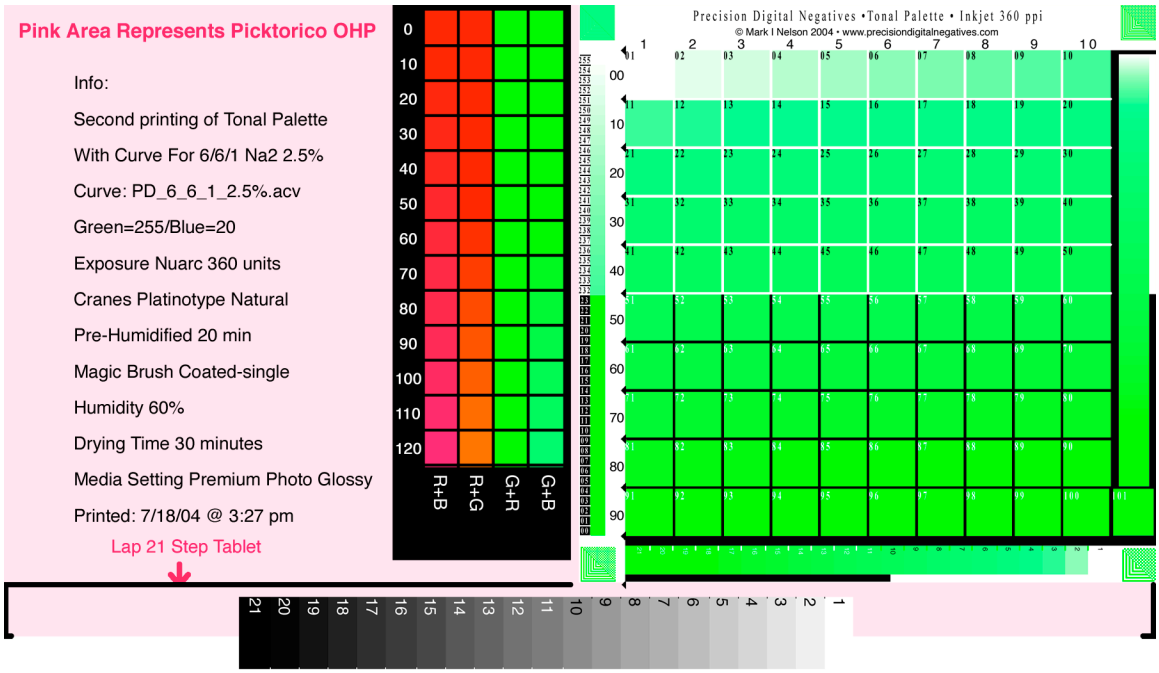

Figure 16.20 Suggested Layout for Printing Tonal Palettes

You will notice that the layout shown in Figure 16.20 only includes a portion of the Color Density Range Palette. Including only that part of the Color Density Range Palette that includes the Standard Color Density and neighboring values saves space. In this case, the cropped section of the Color Density Range Palette has been pasted into the file with the Tonal Palette so that only one negative is used in printing. As always, the Standard 21-Step Tablet is included.

If at some point in the future after you have calibrated a process you find that something seems to be off in the print tonal values, use the same layout shown above, with the Process Adjustment Curve applied to the Tonal Palette, to run a test. Measure the values of the Tonal Palette and enter them into the Curve Calculator, Grid B to see if the Process Adjustment Curve is still giving the same values. Go through the same evaluation procedure defined for the Second Printing of the Tonal Palette.

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Part 5
Making Prints

Figure in Tree —m nelson © 2003

I love the medium of photography, for with its unique realism it gives me the power to go beyond conventional ways of seeing and understanding and say, "This is real, too."
—Wynn Bullock

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CHAPTER XVII: MAKING A DIGITAL NEGATIVE AND A PRINT

Now the careful work you did in calibration begins to pay off! This Chapter describes the steps to follow each time you make a new negative and print. Should you want to experiment by changing any of the basic variables of contrast mixture, exposure time, negative density range, or Process Adjustment Curve, you should repeat the calibration steps.

ADJUSTING THE IMAGE FILE BASED ON THE TONAL PALETTE—THE TWEAKER CURVE

In this part of the workflow, you are checking the image as prepared against the *second printing* of the Tonal Palette. The purpose of doing this is to determine if the image, as you have adjusted it, is going to print with the desired tonal values. The Tonal Palette indicates what different levels of tone in the image will look like when printed. Since thinking backwards is probably as hard for you as it is for me, there is a reference file included with this system called *TonalPaletteConverter.psd*. Print out this file on a piece of film so you can place it over the Tonal Palette and easily determine the reference numbers you will need to coordinate between the image file and the Tonal Palette. The Tonal Palette Converter is shown in Figure 17.1.

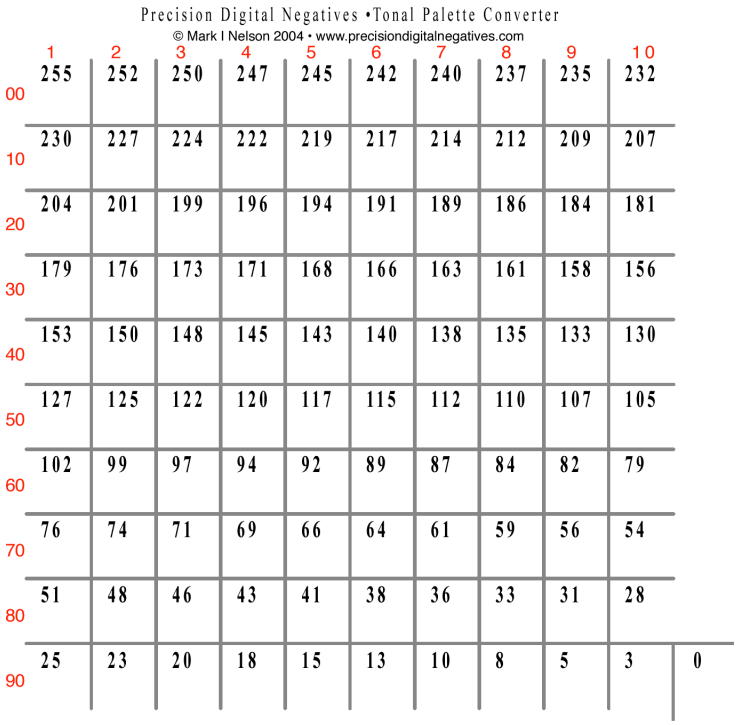

Figure 17.1 The Tonal Palette Converter Provides Tonal Values For the Steps of the Tonal Palette

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The values for each step of the Tonal Palette Converter represent values in the *negatives* you make for printing *prior* to adjustment with the Process Adjustment Curve. To make an adjustment curve to tweak the values of the image to match printed tones in the second printing of the Tonal Palette (with the Process Adjustment Curve Applied), do the following:

1. Place the Tonal Palette next to the monitor and make sure it is lighted well enough so that you can see the printed tonal values of the steps easily.
2. Open the image file.
3. Open the Info Window and place it off to the side so that it does not cover the image. Examine the positive image and pick areas that are important components of the composition in the shadows, midtones and highlights. Think of the print you are going to make. Look at the Tonal Palette and determine which of the steps will best represent the tonality of the four areas you have picked.
4. Select the Color Sampler Tool from the Tool Box. The Color Sampler Tool is one of the optional forms of the Eyedropper Tool, which is selected by clicking on the Eyedropper tool and holding down the mouse button. Using the Color Sampler Tool, click on the four areas of the image that you have determined to be areas of critical tonality. With each click on the image, you will see a sample point appear on the image. At the same time, information for that sample point will appear in the Info Window.
5. Next, invert the image to the negative state. Notice the tonal values for the four points in the Info Window are inverted also. Isn't that a handy piece of magic?
6. Next, add a new Curves Adjustment Layer (*Layers>New Adjustment Layer>Curves*). Give it a name like Tonal Palette Match. Move the Curves Adjustment Window to the side of the screen and size the image on the screen so the entire image is visible.
7. Click on the Curves Adjustment Window to make it active. Move the pointer so that it is over the point that you picked in the shadows. Notice the pointer turns into an eyedropper when it is over the image. Hold down the Command/Apple Key on a Mac (Control Key in Windows) and click with the eyedropper. This places an adjustment point for that tone on the Curve.
8. Look at the Tonal Palette Converter and find the nearest value (0–255) for that point. Now find the associated step on the Tonal Palette. If the step on the tonal palette has the printed density you visualize for this shadow area, then follow this same procedure for the midtone point you selected and then the highlight point you selected.
9. If the step on the Tonal Palette looks lighter or darker than you visualize for this shadow area, then find the step on the Tonal Palette that does have the tonal density you wish this shadow area to print (confusing sentence).
10. Once you locate the step, use the Tonal Palette Conversion chart to determine the level (0-255) for that step. This value becomes the *Output Value* for the point you just added. If the desired tone is darker, use the Down Arrow key to nudge the point down until you reach the desired lower Output Value for the point is the same as the step on the Tonal Palette Converter you chose. If the desired tone is lighter, use the Up Arrow key to nudge the point up until you reach the desired higher Output Value for the point equal to the value for the step of the Tonal Palette Converter you chose.

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11. Using this same procedure, move to the next point in the midtones and make any adjustment if necessary. Finally do the same for the highlight area you chose. Notice that you only use the Up or Down keys to nudge the points. If you use the Left or Right Arrow keys, you are losing the Input Value of your original sampling point and the adjustment will not be correct. Should this happen, select the wayward point and drag it off the curve and grid to get rid of it. Start over with a new point.
12. If you do not want to adjust one of the four sample points, such as one of the midtone sample points, it is best to leave it on the curve anyway. Doing this anchors the values of that range of midtones so they will not be affected as much by the shadow and highlight adjustments.
13. Next, save the Curves Adjustment Layer with a name that is meaningful in the working folder for this image.

These adjustments, if any, should be very slight adjustments. If you find you need to make stronger adjustments, then that is an indication that the original file preparation was not as close as it should have been in the first place—or you should re-evaluate your workflow.

USING THE TWEAKER ADJUSTMENT CURVE YOU JUST MADE

Remember that the Tweaker Adjustment Curve you just made using the tones of the second printing of the Tonal Palette is a curve that will be used to adjust the *negative* image, not the positive image.

When you are working with the image to print the negative on film, wait until after you convert the image to the negative state, then create a new Curves Adjustment Layer (*Layers>New Adjustment Layer>Curves*) and load the curve you just made and continue following the regular procedure of the preparation of the negative described in following sections.

You should now be at the point in your workflow where you are ready to create a negative. The following sections cover the steps for creating inkjet, Laser/LED and imagesetter negatives.

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CREATING THE INKJET NEGATIVE

The following steps outline the process for creating an inkjet negative:

1. Make a working copy of the image file and save it in a folder for negatives
2. Merge all the layers, including adjustment layers
3. Size the image to the dimensions for your negative at 360 ppi
4. Based on the desired size of the print, apply final sharpening
5. Add a digital smooth gradient and digital 21-step tablet to your file for evaluation (files included on disk)
6. If the file is in Grayscale Mode, convert it to RGB Mode
   Note: It is important that the file be in RGB mode prior to inverting to negative!!
7. Invert the image to negative state
   Note: With a few processes, such as Photogravure, the image is NOT inverted to the negative state.
8. Apply a Tweaker Curve if desired
9. Apply the Process Adjustment Curve derived during the Calibration Process
10. Create a new layer and set the Layer Mode to Screen
11. Using the Paint Bucket Tool, fill the new layer with the Standard Color Density determined during the Calibration Process
12. If you want to check the Standard Color Density, include a section of the Color Density Range Palette
13. If you wish a border to keep brush strokes from printing, set the background color to black and using Canvas Size, add a border of appropriate width
14. Load the sheet of film substrate into the printer and make sure the emulsion side is the printing side
15. From the FILE menu, choose Print With Preview
16. Follow the instructions in the Chapter on Printer Setup and print the negative

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Creating the Laser/LED Negative

The following steps outline the process for making a Laser/LED negative:

1. Make a working copy of the image file and save it in a folder for negatives
2. Merge all the layers, including adjustment layers
3. Size the image to the dimensions for your negative at 300 ppi
4. Based on the desired size of the print, apply final sharpening
5. Add a digital gradient and 21-step tablet to your file for evaluation
6. If the file is in Grayscale Mode, convert it to RGB Mode
   Note: It is important that the file be in RGB mode prior to inverting to negative!!
7. Invert the image to negative state
   Note: With a few processes, such as Photogravure, the image is NOT inverted to the negative state.
8. Apply a Tweaker Curve if desired
9. Apply the Process Adjustment Curve derived during the Calibration Process
10. Create a new layer and set the Layer Mode to Screen
11. Using the Paint Bucket Tool, fill the new layer with the Standard Density Color determined during the Calibration Process
12. If you want to check the Standard Color Density, include a section of the Color Density Range Palette
13. If you wish a border to keep brush strokes from printing, set the background color to black and using Canvas Size, add a border of appropriate width
14. Send the file to the service bureau

Creating the Imagesetter Negative

The workflow for preparing an image to create an imagesetter negative is fairly simple. You prepare the image in Photoshop™ just as you would prepare it for making an inkjet print. Remember, there is no way to adjust the overall density of the negative other than by using the Process Adjustment Curve.

1. Once the image is prepared to your satisfaction then you do the following:
2. Make a working copy of the image file and save it in a folder for negatives
3. Merge all layers of the image, including adjustment layers
4. Size the image to the dimensions requirements of your final negative
5. When sizing the image, set the resolution of the image to 300 ppi for stochastic screens
6. Based on the desired size of the print, apply final sharpening
7. Add a digital gradient and 21-step tablet to your file for evaluation
8. Invert the image to the negative state
   Note: With a few processes, such as Photogravure, the image is NOT inverted to the negative state.
9. Apply a Tweaker Curve if desired
10. Apply the Process Adjustment Curve to the entire image file
11. Invert image back to the positive state
12. Convert the file from 16-bit grayscale to 8-bit grayscale

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13. If you wish a border to keep brush strokes from printing, set the background color to White and using Canvas Size, add a border of appropriate width
14. Deliver the file to the service bureau and ask that your file be printed "As a negative on film, emulsion side down, right side reading"

PRINTING THE NEGATIVE

You now have a negative ready to print. Be sure to include a Standard 21-Step Tablet alongside the negative lapped over an edge of substrate, just as in the calibration process. This will be extremely important later in evaluating the results. Print the negative using the same contrast mixture and Standard Printing Time that you determined during the calibration process. Remember, changing paper, humidity, or other variables can cause your print to vary from the expected outcome. Be sure to let the print dry completely before evaluating it. A print that appears and feels dry can look very different the next day. Oh, and wear the pair of lucky underwear that you wore during calibration! ☺

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CHAPTER XVIII: EVALUATING THE PRINT

I divide the print evaluation into three areas, the Alternative Process Evaluation, the Negative Evaluation, and the overall Print Evaluation.

THE ALTERNATIVE PROCESS EVALUATION

The Alternative Process Evaluation focuses primarily on the Standard 21-Step Tablet. If the step tablet printed with the same number of steps as during calibration, then you know that any problems with the print are related to the negative or the original image file. Compare this printed step tablet with the one printed during the Calibration Process—it should be identical to the one printed with the second Tonal Palette. If not, then examine the two and see what process printing variable may have gone wrong. Both printings of the Standard 21-Step Tablet should show the same number of steps with tone. This indicates that the chemistry and exposure were identical. The separation shown between step #1 and step #2 should also be identical.

THE NEGATIVE EVALUATION

The Negative Evaluation is a bit more complex:

The digital 21-step tablet incorporated within the digital negative will not print the same as the Standard 21-Step Tablet. The two step tablets have different densities at like numbered steps. The digital step tablet should print with tone at all but the highest step. The Standard 21-Step Tablet should print without tone in the higher steps.

Examine the digital gradient you included next to the image to see if it printed with smooth tonality and good, even tonal distribution as shown in Figure 18.1.

Figure 18.1 The Gradient

Examine the digital 21-step tablet you included with the image to see if it printed with even separation between the tones as shown in Figure 18.2.

Figure 18.2 The Digital Step Tablet

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If both of these indicators look fine, then the Process Adjustment Curve was accurate. If not, compare the print to the second printing of the Tonal Palette to see if the Process Adjustment Curve gave the same results in both cases. If not, you will most likely need to re–calibrate the curve.

Overall Print Evaluation

If the digital gradient and the digital step tablet look fine, examine the printed image. Look for blocked up shadows, blown out highlights or flattened midtones. If you see problems in any of these areas, then examine the original image file carefully on the monitor. Examine the areas where the print exhibits problems. Most likely you will see a similar problem in the image. This is due to incorrect local tonal values in the image file that resulted from either an error in correction during the Image File Preparation phase or the monitor may not be calibrated correctly. If the latter is the case, then recalibrate the monitor.

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CHAPTER XIX: CHEMISTRY OR CURVE–WHEN TO USE ONE, THE OTHER, OR BOTH

THE INTERACTION OF PROCESS CHEMISTRY AND THE NEGATIVE

The print you make with your digital negative may be exactly what you hoped to achieve. It may perfectly match your vision of the printed image and have the exact "feel" you were looking for. Or, it may not. If you wish to achieve a different look and feel to the printed image, then you may want to consider altering the Process Adjustment Curve or the Process Chemistry.

If you are having difficulty deciding whether to adjust the curve or the chemistry, decide whether the change in tonal representation you wish to achieve is possible by adjusting the chemistry. If so, it is better to do it this way than with the curve—if the adjustment would require a more radical curve. If the adjustment can be made with a less radical curve, then adjust the curve. This rule will give richer tonality in your prints, since you are destroying fewer tones with the Process Adjustment Curve.

You can easily learn to make a "perfect" Process Adjustment Curve, however, if you stop there, you lose all the wonderful characteristics that Alternative Process prints are prized for. All your prints will have the same tonal relationships regardless of what contrast mix you use. If you make a perfect curve for each contrast mix, that linearizes the printed tones to exactly match the image on the monitor, the prints will be indistinguishable. The Calibration System is thus intended as a starting point. True mastery of the digital negative occurs when you are able to go beyond the perfect curve and use the interaction of printing time, contrast mix, negative contrast range, and the curve to make a print. Then you have reached the point where you truly have command of the process and are using it creatively —allowing the unique characteristics of the alternative process to emerge and blend with your treatment of the print image.

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CURVES ON CURVES & HOW TO ADD 2 CURVES

Once you have developed a Process Adjustment Curve, you may wish you could adjust it a little to get slightly more or less contrast, to open up the shadows just a bit, or to bring just a bit more texture in the highlights. You can tweak points on a Process Adjustment Curve, however this can be somewhat confusing regarding the overall affect such adjustments might have.

Another approach is to use two curves. The first curve would be the Process Adjustment Curve that you determined during the calibration process as shown in Figure 19.1.

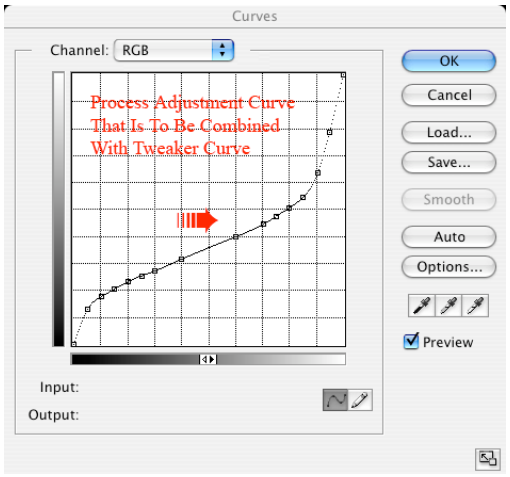

Figure 19.1 The Process Adjustment Curve to be Tweaked

The second curve would be a slight adjustment curve used to accomplish the adjustments you wish to make to the negative. This can be accomplished by simply adding a second Curve Adjustment Layer on top of the Process Adjustment Curve layer when you create the negative. When you do this, be careful not to overdo the adjustment. If you wish to increase the contrast of the print slightly, then you would use a gentle *S shaped* contrast curve on top of the Process Adjustment Curve as shown in Figure 19.2.

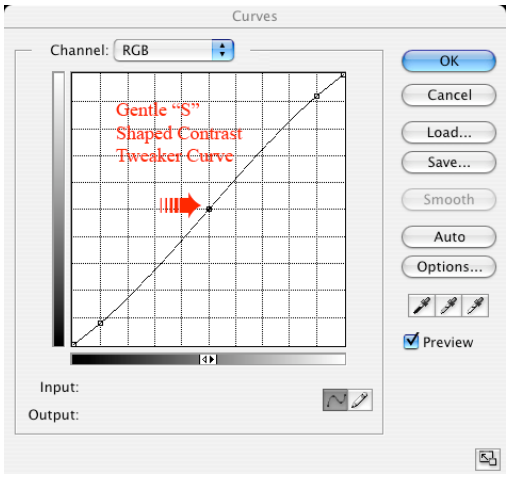

Figure 19.2 Tweaker Curve to Increase Contrast

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If you wish to decrease the overall contrast of the print slightly, then you would add a gentle *Reverse S shaped* Curve that would reduce contrast as shown in Figure 19.3.

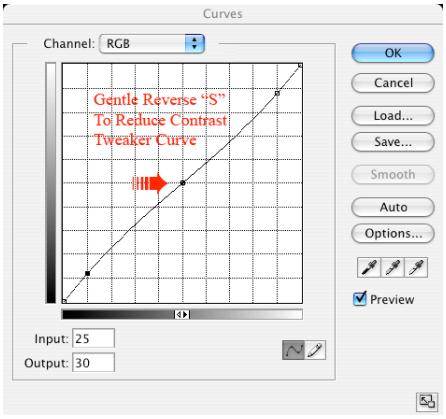

Figure 19.3 Tweaker Curve to Decrease Contrast

If the curve works well and the resulting print seems perfect, then you can either continue to work with the two curves in combination with each other or combine them into one curve. Here is a simple method for combining two curves using a file provided with the system:

1. Open the file called *CurveCombiner.psd*.
2. Create a Curve Adjustment Layer (*Layers>New Adjustment Layer>Curves*)
3. Load your Process Adjustment Curve into this layer and name the layer for the curve
4. Create a second Curve Adjustment Layer
5. Load the Tweaker Curve you created into this layer and name the layer for this curve
6. Make sure both layers with curves are visible/active
7. Open the Info Palette
8. Note that each of the 21 steps is marked with an Input Tonal Level Value (0–255) for the combined curve—you will not use the endpoints, steps #1 and #21
9. Using the Eyedropper Tool, measure the values of each of the 19 steps
10. The measured value of each corresponding step is the Output Value for the new, combined curve

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For each of the 21 steps, you will have a set of two numbers, the Input and Output values for the new combined curve. Figure 19.4 shows the Layers Palette with the two curve layers and the Curve Combiner Layer.

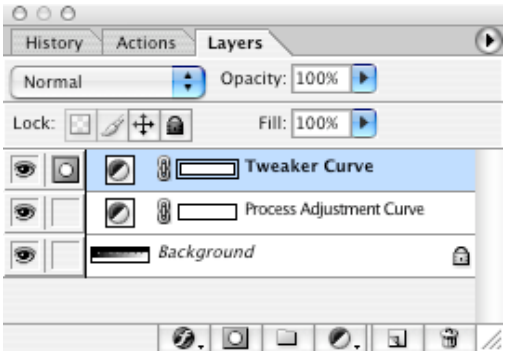

Figure 19.4 Layers Palette With Two Curve Layers

Figure 19.5 shows the Curve Combiner step tablet being sampled after the two curves have been applied in order to obtained the Output Values for the new combined curve.

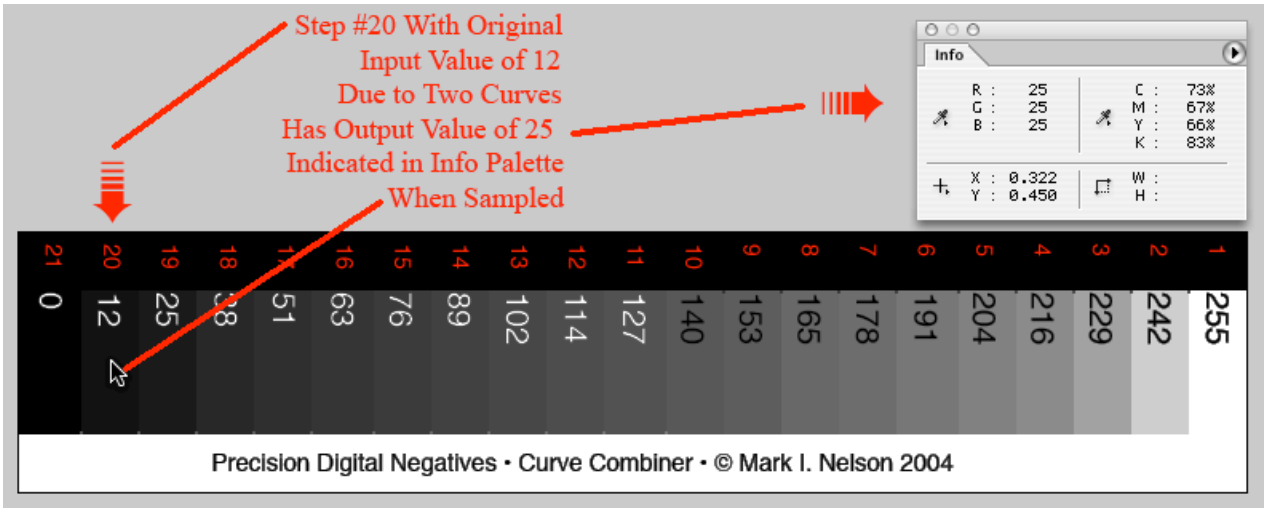
Step #20 With Original
Input Value of 12
Due to Two Curves
Has Output Value of 25
Indicated in Info Palette
When Sampled
Info
R : 25
G : 25
B : 25
C : 73%
M : 67%
Y : 66%
K : 83%
X : 0.322
Y : 0.450
W :
H :
21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
0 12 25 38 51 63 76 89 102 114 127 140 153 165 178 191 204 216 229 242 255
Precision Digital Negatives • Curve Combiner • © Mark I. Nelson 2004

Figure 19.5 Sampling the Steps for the New Curve's Output Values

Next turn off the two adjustment layers with the Process Adjustment Curve and the Tweaker Curve. This will restore the step tablet to the original values.

Now create a new Curve Adjustment Layer and using these new Input and Output values define the new combined curve. Move the Curve Adjustment Window so that you can see the entire step tablet. Remember, you can only add 14 points to define a curve. The endpoints should remain at 0/0 and 255/255, so as you add points, pick the most strategic points first.

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As you add points to the curve, check the new adjusted values of the steps by moving the pointer over the steps and watching the values in the Info Palette. Notice the Info Palette lists both the Input Value and Output Value for each step. Upon completion, the new combined curve should show almost exactly the same adjusted values as you were getting using both the Process Adjustment Curve and the Tweaker curve combined. You may find a few steps that vary, but they will probably be within very close tolerances, possibly +/- one level of 256 (0–255). Figure 19.6 compares the three curves.

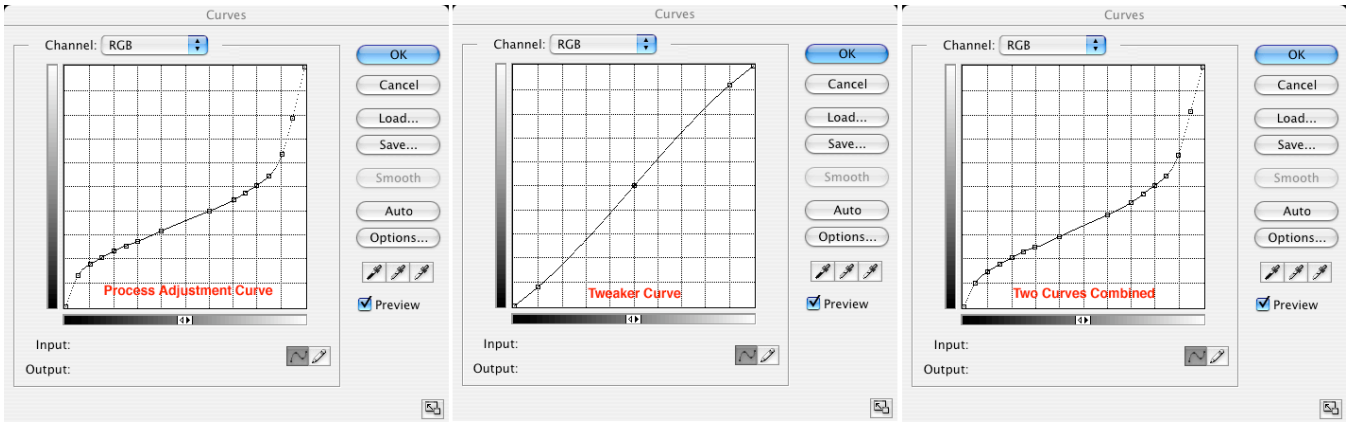

Figure 19.6 Results of Combining Process Adjustment Curve and Tweaker Curve

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CHAPTER XX: THE FUTURE

WHERE DO I GO FROM HERE?

I have learned that when you write a book like this, it never seems finished. I think there are two reasons for this.

First, you keep tinkering with the structure, descriptions and words because you want to communicate your ideas to the reader as clearly as possible. Quite often while editing yesterday's writing at breakfast the next day at my favorite restaurant, I would imagine one of my friends sitting across from me in the booth listening as I read the text—as if I were having a conversation. Unfortunately my volunteer friend often fell asleep—well not always. Eventually though, reality sets in and you realize that the book will never get published if you keep on tinkering with it. So, you pronounce it *DONE*!

Second, you keep thinking of new ways of doing things, how to improve the process, and new applications of the process. While this is wonderful and exciting, this is the most dangerous roadblock to completing a book! Finally I decided on a compromise that seemed to make sense. I keep a list of things I want to try or test, improvements I can make to Palettes or Software, and new areas to explore. After completing the book, I will start on that list. For those people who buy the book and register at the www.precisiondigitalnegatives.com website, I will post some of this newer work. Other tips and tricks I will probably just include in workshops.

There will be a lot of new things to explore with this method!

WHERE DO YOU GO FROM HERE?

This is probably the more important of the two questions. From my experience with the people doing beta testing with this system, I found that at first, people tend to learn how to go through the calibration process and are very pleased with the quality and repeatability of the prints. In the process of doing this they become more aware of the importance of being consistent with exposure times, chemistry and other printing variables. They tend to fine-tune their whole printing process and look more critically at each part of the process. Doing so, along with a better understanding of how digital negatives really work, tends to instill a greater sense of confidence in their work.

The second *phase* of discovery tends to come later as the photographer begins to truly understand the beauty and simplicity of the system. At this point a person can begin to experiment and manipulate the system in order to create prints that truly match one's vision. Once mastered, the technical aspect of making prints takes hind seat to the artistic side. When a beautiful hand-made print is placed on the wall for others to view, it takes on a life of its own. The technology behind the crafting of the print is no longer relevant. What matters is the response of the person viewing the print.

Part 6
Appendix

Girl Talk —m nelson © 2000

Sometimes the Toe of a Curve is more interesting than the Shoulder.
—Mark Nelson

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APPENDIX A: GLOSSARY OF TERMS

- ***Baseline Printing Time:***
  The amount of exposure necessary to produce the merging of steps #1 and #2 of a Standard 21-Step Test Tablet when printed with a given photographic process. Steps #1 and #2 would thus print with the same reflection density. (See *Standard Printing Time*)

- ***Color***
  Synonymous with Hue.

- ***Color Density:***
  The density produced by a particular color or hue at maximum saturation when printed with a given alternative process.

- ***Color Density Range Control*** *Patent Pending* ***:***
  The use of varying colors or hues in fabricating digital negatives to match the density range of the negative to the Exposure Scale of the alternative process.

- ***Color Density Range Palette:***
  A file, created in Photoshop™, which generates a step tablet with steps of color modified in graduated increments such that, when printed using the Standard Printing Time with an alternative photographic process, is used to determine the Standard Color Density for that process (given a specific contrast mix for that process, if applicable).

- ***Digital 21-Step Test Tablet:***
  A file created in Photoshop™ with 21 equally spaced steps of tones with an increment of 12.8 tones from 0 (black) to 255 (white). This test tablet is used for visual evaluation of the negatives relative printed densities. The steps will have different density values than a Standard 21-Step Test Tablet and will only print in a linear fashion if the correct Process Adjustment Curve has been applied to the digital file.

- ***Digital Gradient:***
  A file created in Photoshop™ that is a smooth gradient from level 0 to level 255. The gradient can be created with the Gradient Tool in Photoshop™ or, more accurately, by hand, as the one which accompanies this book.

- ***DMax:***
  The highest density of a print (reflection density) or negative (transmission density).

- ***DMin:***
  The lowest density of a print (reflection density–paper white) or negative (transmission density–base plus fog).

- ***Exposure Scale***
  The amount of light required for a given photosensitive process to produce all the tones it is capable of producing.

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- ***H&D Curve***
  A graph that represents the sensitivity of an emulsion to light.

- ***Ink Grain***
  The pattern of ink dots rendered by an inkjet printer when printing a digital negative—analogous to film grain.

- ***Hue***
  The correct term for what is commonly referred to as Color.

- ***Ink Set***
  Ink Set refers to all the different color inks designed for use with a particular printer, either by the printer manufacturer or a third party ink manufacturer. Ink Sets are comprised of individual inks following a CMYK model—Cyan ink (C or c-diluted C), Magenta ink (M or m-diluted M), Yellow ink (Y) and Black ink (K or k). Some ink sets include diluted forms of these inks that may be designated as CcMmYKk. Other ink sets may include additional red, blue, orange or green inks to increase the gamut or to address difficulties in rendering certain colors accurately. The Precision Digital Negative system uses the CMY inks or CcMmY inks in a given ink set.

- ***Ink Set Color Branch:***
  Steps of transitional color that occur when decreasing one of the two inks that are the component of Red, Green or Blue printed color. Since each of these three primary colors is rendered with two component inks, each ink set has 6 branches, two for each primary color. The two branches of a primary color such as green transition from green to each of the two component inks, yellow and cyan, respectively. Each step on a branch has a different log density. While most branches from a primary color (Red, Blue, or Green) will have an overall trend line towards lower density as the color moves away from the primary color, there are cases where there will be an initial rise in density before the trend begins downward. This initial rise in density will usually occur in the branch with the Yellow ink component.

- ***Ink Set Color Density Signature:***
  The pattern produced when graphing the log transmission densities of varying colors or hues of an ink set. Different ink sets will produce a different pattern or signature.

- ***Linearize or Linearization***
  The application of an adjustment curve to a digital image file, which causes the log densities of a print made from the digital image file to vary in a linear fashion with the image file tonal values.

- ***Print Linearization Curve***
  A Print Linearization Curve is a Process Adjustment Curve developed from the reflection density values of a print made using the alternative process. This Process Adjustment Curve will render a print that is identical to the tonal values of the image when viewed on the monitor.

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- ***Process Adjustment Curve:***
  A curve that adjusts the tonalities of an image file so that a negative made from the file will print appropriately with a given alternative process. There are two types of Process Adjustment Curves, one derived from the density curve of the negative output device (Negative Linearization Curve) and the second derived from the print (Print Linearization Curve) made using the alternative process.

- ***Standard 21 (31)-Step Test Tablet, Step Wedge, or Sensitivity Guide:***
  A commercially available transmission step tablet with 21 steps of increasing density in increments of log .15, which is equivalent to 1/2 stop exposure. When contact printed next to digital negatives and palettes, this provides a check for consistency of contrast mix, exposure and other printing variables. A Standard 31-Step Test Tablet has 31 steps of increasing increments of log .10 density, which is equivalent to 1/3 stop exposure.

- ***Standard Color Density:***
  The color or hue in a negative which prints with just enough density to produce paper white with a given alternative process contrast mix when printed with the Standard Printing Time for that alternative process.

- ***Standard Color Density Range:***
  The density range produced within a negative by a given Standard Color Density printed from 0%-100% saturation.

- ***Standard Color Density Range Potential:***
  The Standard Color Density Range Potential of an ink set is the difference between the log transmission density of the color that produces the highest log transmission density (usually a mix of magenta and yellow or a mix of cyan and yellow) and the log transmission density of the color that produces the lowest log transmission density (usually pure magenta).

- ***Standard Printing Time:***
  The amount of exposure used with a digital negative. The Standard Printing Time is determined from the Baseline Printing Time by reducing the exposure by one step on the step tablet used to determine the Baseline Printing Time. In the case of a Standard 21-Step Tablet with steps in increments of log .15 density, the Standard Printing Time would equal the Baseline Printing Time multiplied by .71. (See Baseline Printing Time)

- ***Target Density:***
  The shift in printed density for a tonal level (0–255) in an image file achieved with the proper Process Adjustment Curve.

- ***Tonal Palette:***
  A digital 101-step tablet rendered on film using the Standard Color Density (or in the case of imagesetter negatives in 8-bit grayscale mode) that is used to determine the Process Adjustment Curve for a given alternative process printed with the Standard Printing Time. Once printed with an alternative process using the Process Adjustment Curve, the printed Tonal Palette provides a visual tonal index that can be used for planning and predicting the tonal values of a print.

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APPENDIX B: SUGGESTED READING

Anchell, Stephen G. *The Darkroom Cookbook, Second Edition*. Boston: Focal Press, 2000.

Anderson, Christina Z. *The Experimental Photography Workbook*. Bozeman: University Press, 2003.

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Arnow, Jan. *Handbook of Alternative Photographic Processes*. New York: Van Nostrand Reinhold, 1982.

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(Includes a chapter on Carbon by Sandy King and a chapter on Full Color Gum Printing by Sam Wang.)

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Sullivan, Richard, and Weese, Carl. *The New Platinum Print*. Santa Fe, NM: Working Picture Press, 1998.

Wang, Sam. *Tri-Color Gum with Cyanotype*. Online Journal: The Unblinking Eye, 2003. (http://unblinkingeye.com/Articles/3CG/3cg.html)

The World Journal of Post-Factory Photography, ed. Judy Seigel. New York: Post-Factory Press

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APPENDIX C: RESOURCES

Artcraft, PO Box 583, Schenectady, NY 12301, 518-355-8700, order 800.682.1730, www.artcraftchemicals.com. (Photo Chemicals)
Bostick & Sullivan, Santa Fe, NM, 87592, 505-474-0890. www.bostick-sullivan.com (Photo Chemicals, Papers, Other Alt Photo Supplies)
Daniel Smith, PO Box 84268, Seattle, WA 98124m, 800-426-6740. www.danielsmith.com (Wide selection of art papers.)
Doug Kennedy, PO Box 3433, Lake City, CA 96115, 530.279.6228, email at dbkennedy@ndo.net (High quality contact printing frames.)
Imacon (High Quality Film Scanners and Digital Camera Backs)
Light Impressions, (Archival Storage Supplies) www.lightimpressionsdirect.com
Michael Smith (Kodak Azo Paper) www.michaelandpaula.com/mp/index_skip.html
NUARC (Ultraviolet Exposure Devices) www.nuarc.com
Photographers' Formulary, PO Box 950, Condon, Montana 59826, 800-922-5255. www.photoformulary.com (photo chemicals and supplies including contact printing frames.)
Pictorico (Transparency Film) www.pictorico.com
Reindeer Graphics, Inc. Unusual graphics software & a free Photoshop Plugin called Wide Histogram that shows a histogram greater than 8-bits www.reindeergraphics.com/free.shtml
Stephen Kinsella Fine Art Papers, PO Box 32420, St. Louis, MO 63132, 800.445.8865. www.kinsellaartpapers.com (Wide selection of art papers.)
Stouffer Industries (Step Tablets, Step Wedges, or Sensitivity Guides)
Xrite (Densitometers) www.xrite.com

& of course,

Precision Digital Negatives, Inc. – www.precisiondigitalnegatives.com
(Look for additional items listed at this site which you may find valuable in your workflow when making digital negatives.)

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APPENDIX D: LINKS

www.Aikosart.com (Large selection of Japanese Hand Made Papers & Book Making Supplies)
www.albumenworks.com
www.apug.org (Online Discussion Group Regarding "Traditional Photography")
www.artcraftchemicals.com (Photographic Chemicals)
www.bandwmag.com (B&W Magazine-Black and White)
www.bostick-sullivan.com (Alt Photo Supplies)
www.btzs.org (Beyond The Zone System website and forum)
www.btzs.org (Beyond The Zone System, Phil Davis's Website)
www.calumetphoto.com (Photographic Supplies)
www.cameraarts.com (The Art & Craft of Photography in the 21st Century)
www.copygsf.com (Imagesetter Negatives, contact Peter Ellzey)
www.dickarentz.com (Dick Arentz Books, *Platinum & Palladium Printing*, Na2 Contrast Control)
www.fishersci.com (Chemicals and Equipment)
www.graphicchemical.com (Printmaking Supplies)
www.gretagmacbeth.com (Macbeth Color Management & Monitor Calibration)
www.Lenswork.com (Lenswork Journal and Lenswork Editions-using digital negatives)
www.lightboxinc.com (Custom Digital Negatives & Printing)
www.lightimpressionsdirect.com (Archival Storage Supplies)
www.MarkINelsonPhotography.com (Photography by Mark I. Nelson, the author)
www.michaelandpaula.com/mp/index_skip.html
www.photoeye.com (Books on Photography)
www.photoformulary.com (Photographic Supplies)
www.pictorico.com (Negative Film Substrate)
www.pinholeresource.com
www.pinholeresource.com (Pinhole Cameras, Resource Information, & *Pinhole Journal*)
www.precisiondigitalnegatives.com (Book Sales, Resources for Registered Users)
www.reindeergraphics.com/free.shtml (Interesting Graphics Software and free Wide Histogram Photoshop Plugin that shows data information above 8 bits)
www.stouffer.net (Step Tablets)
www.unblinkingeye.com (Online Alternative Photo Journal—Ed Buffaloe)
www.viewcamera.com (The Journal of Large-Format Photography)
www.viewcamerastore.com (Photography Supplies & Beyond The Zone System Products)
www.xrite.com (Densitometers)